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The **GENERAL PRACTITIONERS' COURSE** (15th August to 10th September) will include Demonstrations on Anatomy, Radiology, Post-Mortem Work, and Clinical Instruction in Insulin Therapy, Tuberculosis, Fevers, Diseases of Children, Obstetrics, Surgical Out-Patients, Gynæcology, General Surgical Diagnosis, Ophthalmology, Ear, Nose and Throat Work, Dermatology, as well as General Medical Clinics, and Special Instruction in the Examination of the Nervous, Circulatory, Respiratory, Alimentary and Renal Systems.

The **GENERAL SURGICAL COURSE** (15th August to 10th September) will include Lecture-Demonstrations on Surgical Anatomy, Surgical Pathology, Surgical X-Ray Diagnosis and Surgical Physiology; Clinical Instruction at the Royal Infirmary and Royal Hospital for Sick Children; Clinical Instruction in Venereal Diseases; Orthopædics; Surgical Out-Patients; and Special Instruction in Abdominal and Genito-Urinary and other branches of Surgery.

The **COURSES IN OBSTETRICS AND GYNÆCOLOGY AND ON DISEASES OF CHILDREN** will be held in the afternoon during the period of the General Courses.

In addition to the above, the following **SPECIAL COURSES** have also been arranged:—

SUMMER TERM—(May-July)

TUBERCULOSIS—Professor Sir Robert Philip. The Course, which lasts one month, will include study of the Clinical, Pathological, and Administrative Aspects of Tuberculosis. It will be conducted at the Royal Infirmary, Royal Victoria Hospital, the Tuberculosis Dispensary, Southfield Sanatorium Colony, and at other Tuberculosis Institutions. The Course will commence on 27th April. Fee, £10, 10s.

SURGICAL PATHOLOGY—Mr Wade, F.R.C.S. Ed. The Course will commence on Tuesday, 10th May. Fee, £4s. 4s.

OPHTHALMOSCOPY—Drs Graham and Ligertwood. Twelve meetings. Course commences on 9th May and class meets thrice weekly. Fee, £5, 5s.

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DISEASES OF EAR, NOSE, AND THROAT—Dr Douglas Guthrie. This class will meet twice weekly at the Ear and Throat Dispensary, Cambridge Street. Fee, £4, 4s.

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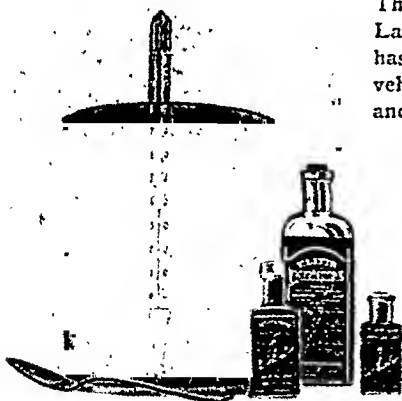
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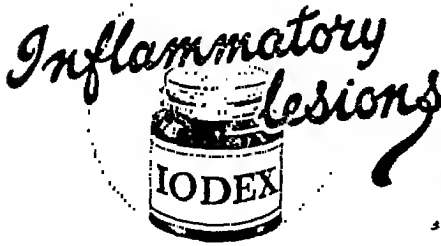
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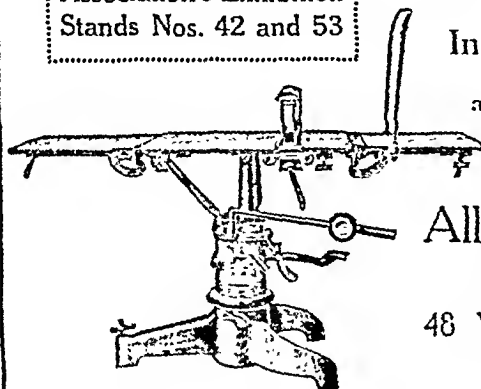
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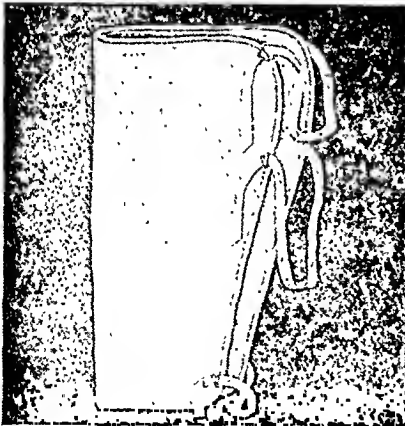
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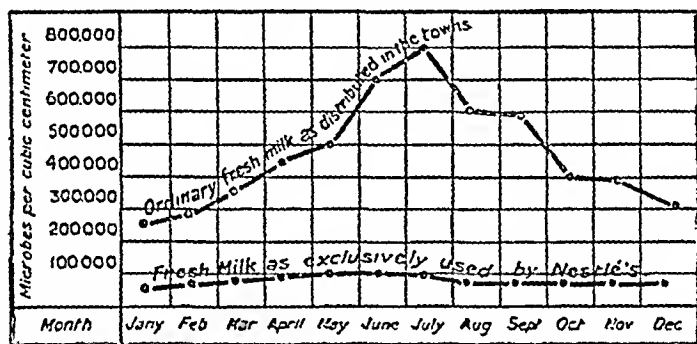
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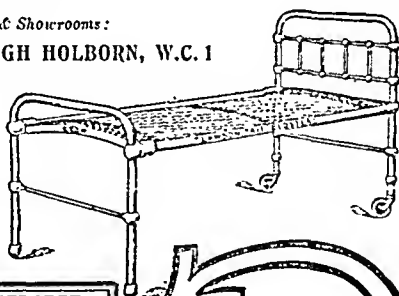
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Publishers of this Journal, will be pleased to consider, with a view to publication, manuscripts that might be added to their series of medical and surgical books, suitable for use as students' manuals, or as text-books for practitioners, research students, and post-graduate work.

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Edinburgh Medical Journal

July 1927

BRITISH MEDICAL ASSOCIATION EDINBURGH MEETING, 1927.

THE ninety-fifth annual meeting of the British Medical Association will be held in Edinburgh from 15th to 23rd July 1927. The Association last met in Edinburgh in 1898. The President-Elect is Sir Robert W. Philip, M.D., LL.D., F.R.C.P. Ed., and the local General Secretary, Dr A. Fergus Hewat, M.D., F.R.C.P. Ed., 14 Chester Street, Edinburgh. A special feature of the meeting will be the Celebration of the Centenary of Lord Lister's Birth.

Lister Centenary Celebration.—A commemoration ceremony in celebration of Lord Lister's centenary will be held in the M'Ewan Hall, Edinburgh, on Wednesday, 20th July, at 8 P.M. The Earl of Balfour, K.G., O.M., will preside, and short addresses will be delivered by Sir William Watson Cheyne, Professor Tuffier (Paris), Professor Harvey Cushing (Harvard University), and Professor John Stewart (Halifax, Nova Scotia).

Throughout the week of the Association Meeting a museum of Lister relics will be on view in the Upper Library of the Old University. The relics will be gathered from many sources. The unique interest of the exhibits will be due largely to the co-operation and liberality of the directors of the Wellcome Historical Medical Museum, London.

A *Lister Memorial Volume* has been prepared and will constitute the book of the Edinburgh Meeting of the Association. A copy will be presented to each member of the Association on registration in the reception room. The volume, edited by Dr Logan Turner, will contain sketches and reminiscences by former house-surgeons of Lord Lister, two of his own scientific addresses, and a series of letters. A section of particular interest is included dealing with the lives of Lister's fellow-residents in the Edinburgh Royal Infirmary during the summer of 1854. Sir Edward Sharpey-Schafer contributes a sketch on

British Medical Association

Lister's work as a physiologist. Mr Miles writes on "Surgery Prior to Lister's Time," and Professor John Fraser on "The Influence of Lister's Work on Surgery."

Memorial inscriptions have been placed on the walls of the houses which Lister occupied successively in Edinburgh—namely, 11 Rutland Street, and 9 Charlotte Square.

A prize of £25 and a gold medal are to be awarded to the writer of the best essay on "The Influence of Lister on Surgery." The prize is open to students and graduates of not more than one year's standing in any medical school in the British Empire.

The following is a summary of the Programme:—

Friday, 15th July.

- 10.0 a.m.—*Representative Meeting.*
- 11.0 a.m.—Civic Welcome to Representative Meeting.
- 1.0 p.m.—Luncheon to Overseas Representatives.
- 7.30 p.m.—Representatives' Dinner.
- 7.30 p.m.—Ladies' Dinner, followed by a Dance.

Saturday, 16th July.

- 9.30 a.m.—*Representative Meeting.*
- 1.0 p.m.—Official Photograph.
- 8.30 p.m.—Smoking Concert (Representatives).
- 8.30 p.m.—"At Home" at Ladies' Club.

Sunday, 17th July.

- 9.30 a.m.—Whole day Excursion to Border and Scott Country.

Monday, 18th July.

- 9.0 a.m.—*Council Meeting.*
- 10.0 a.m.—*Representative Meeting.*
- 2.0 p.m.—Opening of Reception Room.
- 2.0 p.m.—Exhibition open for inspection.
- 7.30 p.m.—Performance at Theatre.

Tuesday, 19th July.

- 9.30 a.m.—Official Opening of Exhibition by President-Elect.
- 10.0 a.m.—*Representative Meeting.*
- 11.0 a.m.—Opening of Pathological Museum.
- 2.0 p.m.—*Annual General Meeting*, followed immediately by Representative Meeting.
- *4.30 p.m.—Official Religious Service at St Giles' Cathedral.
- *8.0 p.m.—*Adjourned General Meeting* and President's Address.
- *9.30 p.m.—Reception by President and Local Executive.
- 10.30 p.m.—Dancing at Palais de Danse.

* Academic dress may be worn at these ceremonies.

Edinburgh Meeting, 1927

Wednesday, 20th July.

- 9.0 a.m.—*Council Meeting.*
- 9.0 a.m.—Exhibition open.
- 10.0 a.m.—*Sectional Meetings.*
- 1.0 p.m.—Irish Graduates' Luncheon.
- *2.0 p.m.—Honorary Graduation Ceremonial.
- 2.30 p.m.—Secretaries' Conference (Branch and Division Secretaries).
Afternoon Excursions.
- *4.0 p.m.—Reception by the University of Edinburgh in Old Quadrangle.
- 6.30 p.m.—Secretaries' Dinner (Branch and Division Secretaries).
- *8.0 p.m.—Lister Centenary Celebration.
- 8.0 p.m.—Concert : Chamber Music.
- 9.0 p.m.—Dancing at Palais de Danse.
- *9.30 p.m.—Reception by the President and Fellows of the Royal College of Surgeons.

Thursday, 21st July.

- 8.30 a.m.—National Temperance League Breakfast.
- *9.0 a.m.—Roman Catholic Mass in Roman Catholic Cathedral.
- 9.0 a.m.—Exhibition open.
- 9.30 a.m.—Golf Competition for Ulster and Childe Cups at Muirfield.
- 10.0 a.m.—*Sectional Meetings.*
Afternoon Excursions.
- 4.0 p.m.—Garden Party at Royal Botanic Garden : Ladies' Committee.
- 7.30 p.m.—*Annual Dinner of the Association.*
- 8.30 p.m.—Concert : Hebridean Music by Mrs Kennedy Fraser and Party.
- 9.0 p.m.—Royal Scottish Academy : Private View.
- 10.0 p.m.—Reception by the President and Members of the Edinburgh Branch of the British Medical Association : Dancing.

Friday, 22nd July.

- 8.30 a.m.—Medical Prayer Union Breakfast.
- 9.0 a.m.—Exhibition open.
- 10.0 a.m.—*Sectional Meetings.*
- 2.0 p.m.—Golf Competition for Treasurer's Cup at Gullane, No. 1 Course.
Afternoon Excursions.
- 4.0 p.m.—Reception by Royal Medical Society.
- 8.30 p.m.—Reception by the Lord Provost and Magistrates of the City of Edinburgh at Scottish Zoological Park.

Saturday, 23rd July.

Whole-day Excursion to St Andrews, including Falkland Palace.

* Academic dress may be worn at these ceremonies.

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The Sections.—The Scientific Sections will meet from 10 A.M. to 1 P.M. for papers and discussions on Wednesday, Thursday, and Friday, 20th, 21st, and 22nd July. The following provisional programmes have been arranged:—

Medicine.—*President:* Professor G. Lovell Gulland, C.M.G., M.D., F.R.C.P. Ed. (Edinburgh). *Local Honorary Secretary:* G. D. Mathewson, M.B., F.R.C.P. Ed., 28A Moray Place, Edinburgh.

Wednesday, 20th July.—Discussion: The Results of Insulin Therapy in Diabetes Mellitus. To be opened by Professor Hugh Maclean (London), followed by Dr George Graham (London) and Professor D. Murray Lyon (Edinburgh).

Thursday, 21st July.—Discussion: The Treatment of Acute Lobar Pneumonia. To be opened by Professor John Hay (Liverpool), followed by Dr H. Morley Fletcher (London) and Dr A. Fergus Hewat (Edinburgh).

Friday, 22nd July.—Discussion: The Pathology and Treatment of Pernicious Anæmia. To be opened by Professor G. Lovell Gulland (Edinburgh), followed by Dr Arthur F. Hurst (Ascot).

Surgery.—*President:* Professor D. P. D. Wilkie, O.B.E., M.D., Ch.M., F.R.C.S. (Edinburgh). *Local Honorary Secretary:* J. M. Graham, Ch.M., F.R.C.S. Ed., 8 Manor Place, Edinburgh.

Wednesday, 20th July.—Discussion: Tuberculosis of the Kidney. To be opened by Sir John Thomson-Walker (London), followed by Dr Rollier (Leysin), Professor A. Fullerton (Belfast), and Mr Henry Wade (Edinburgh).

Thursday, 21st July.—Discussion: The Place of Surgery in the Treatment of Toxic Goitre. To be opened by Mr T. P. Dunhill (London), followed by Professor G. R. Murray (Manchester) and Mr C. Thurstan Holland (Liverpool).

Paper: Sir Almroth E. Wright (London), The Rational Treatment of Infected Wounds.

Friday, 22nd July.—Discussion: Chronic Appendicitis. To be opened by Mr Wilfred Trotter (London), followed by Mr J. W. Dowden (Edinburgh), Mr Victor Bonney (London), and Mr A. J. Walton (London).

Paper: Mr A. M'Lennan (Glasgow), Burns.

Obstetrics and Gynæcology.—*President:* James Haig Ferguson, M.D., C.M., F.R.C.P. Ed., F.R.C.S. Ed. (Edinburgh). *Local Honorary Secretary:* W. F. T. Haultain, O.B.E., M.C., M.B., Ch.B., F.R.C.S. Ed., 6 Walker Street, Edinburgh.

Wednesday, 20th July.—Discussion: The Relation of Pregnancy to General Diseases. To be opened by Professor J. M. Munro Kerr (Glasgow) Cardiac Diseases, Dr E. Rist (Paris) Tuberculosis, and Professor F. J. Browne (London) Venereal Diseases, followed by Dr J. S. Fairbairn (London), Dr G. FitzGibbon (Dublin), and Dr Mary H. J. MacNicol (Edinburgh).

Thursday, 21st July.—Discussion: The Hygiene of Menstruation in Adolescents. To be opened by Professor R. W. Johnstone (Edinburgh), Dr J. Hunter P. Paton (St Andrews), and Mrs A. E. Sanderson Clow (Cheltenham), followed by Mrs E. Vaughan-Sawyer (London).



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Friday, 22nd July.—Papers: Dr F. A. E. Crew (Edinburgh), The Effect upon the Sex Ratio of Conception Early and Late in Relation to the Oestrous Cycle of the Rat; Dr Douglas A. Miller (Edinburgh), Failed Forceps Cases; Dr Daniel Dougal (Manchester), The Clinical Features of Ectopic Pregnancy; Dr W. R. Addis, M.C. (Manchester), A Method of Induction of Labour.

Pathology and Bacteriology.—*President:* Professor J. Lorrain Smith, M.D., F.R.S., F.R.C.P. Ed. (Edinburgh). *Local Honorary Secretary:* James Davidson, M.B., Ch.B., Pathological Department, University of Edinburgh.

Wednesday, 20th July.—Discussion: Growth in its Pathological Relations. To be opened by Dr Archibald Leitch (London), followed by Professor R. Muir (Glasgow), Dr G. W. de P. Nicholson (London), Professor J. Shaw Dunn (Manchester), Professor M. J. Stewart (Leeds), and Professor E. H. Kettle (Cardiff).

Thursday, 21st July.—(Joint meeting with Section of Comparative Medicine.) Discussion: Immunity. To be opened by Dr R. A. O'Brien (Beckenham), and Professor Carl H. Browning (Glasgow), followed by Professor R. Muir (Glasgow), Dr Hedley D. Wright (London), Colonel W. F. Harvey (Edinburgh), Professor T. J. Mackie (Edinburgh).

Friday, 22nd July.—(Joint meeting with Section of Comparative Medicine.) Discussion: Aspects and Problems of Comparative Medicine. To be opened by Dr Theobald Smith (Princeton, N.J.) and Professor Basil Buxton (Cambridge), followed by Major G. W. Dunkin (London). Mr W. H. Andrews (Ministry of Agriculture), Dr F. A. E. Crew (Edinburgh), Dr H. H. Scott (London), Professor R. T. Leiper (London), Mr J. W. Brittlebank, P.R.C.V.S. (London), Mr Arthur Gofton (Edinburgh), Mr T. W. M. Cameron (London), and Mr James M'Allan (Aberdeen).

Therapeutics and Pharmacology.—*President:* Professor J. A. Gunn, M.D., D.Sc. (Oxford). *Local Honorary Secretary:* C. G. Lambie, M.C., M.B., F.R.C.P. Ed., 31 Drumsheugh Gardens, Edinburgh.

Wednesday, 20th July.—10 A.M. to 12 noon. Discussion: Clinical Methods of Administration and Therapeutic Uses of Oxygen. To be opened by Dr E. P. Poulton (London), followed by Dr H. Whitridge Davies (Leeds) and Dr W. T. Ritchie (Edinburgh).

12 noon to 1 P.M. Paper: Professor J. A. Gunn (Oxford), Expectorants.

Thursday, 21st July.—Discussion: The Therapeutic Uses of Calcium Salts. To be opened by Professor F. R. Fraser (London), followed by Dr L. G. Parsons (Birmingham), Mr C. P. Stewart (Edinburgh) Biochemical Aspect, Dr G. H. Percival (Edinburgh) Pharmacological and Therapeutic Aspect, Professor L. Blum (Strasbourg), Dr G. C. Linder (London) Tetany, and Dr N. F. C. Burgess (London).

Friday, 22nd July.—Discussion: The Action and Uses of Ovarian Extracts. To be opened by Professor W. E. Dixon (Cambridge), followed by Dr Katherine A. Coward (London) Standardisation, Mr A. S. Parkes (London) Physiological, Dr W. R. Addis (Manchester) Clinical, and Professor J. M. Munro Kerr (Glasgow) Gynaecological.

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Diseases of Children.—*President*: Professor John Fraser, M.C., M.D., Ch.M., F.R.C.S. Ed. (Edinburgh). *Local Honorary Secretary*: Lewis Thatcher, M.D., F.R.C.P. Ed., 8 Melville Crescent, Edinburgh.

Wednesday, 20th July.—Discussion: Acute Pneumonia in Early Childhood. To be opened by Dr Charles M'Neil (Edinburgh) and Dr Agnes R. Macgregor (Edinburgh) conjointly, followed by Professor Leonard Findlay (Glasgow), Dr J. Hugh Thursfield (London), Colonel W. Glen Liston (Edinburgh), and Dr Norman S. Carmichael (Edinburgh).

Afternoon.—Demonstration: Dr W. A. Alexander (Edinburgh), Acute Pulmonary Conditions in Childhood, illustrated by specimens, X-ray prints, large sections, and microscopic preparations.

Surgical Demonstration at Royal Edinburgh Hospital for Sick Children.

Thursday, 21st July.—Discussion: Acute Intestinal Obstruction in Infancy and Childhood. To be opened by Mr Alex. M'Lennan (Glasgow), followed by Mr L. E. Barrington Ward (London), Miss G. M. A. Herzfeld (Edinburgh), Mr F. C. Pybus (Newcastle-on-Tyne), and Mr Norman M. Dott (Edinburgh).

Afternoon.—Demonstration of Medical Cases at Royal Edinburgh Hospital for Sick Children.

Friday, 22nd July.—Discussion: Therapeutic Modification of the Diet in Infancy: what can be achieved by it? To be opened by Dr H. C. Cameron (London), followed by Dr A. Dingwall Fordyce (Liverpool), Dr G. B. Fleming (Glasgow), and Dr Lewis Thatcher (Edinburgh).

Mental Diseases.—*President*: Professor George M. Robertson, M.D., P.R.C.P. Ed. (Edinburgh). *Local Honorary Secretary*: W. M. M'Alister M.B., Ch.B., M.R.C.P. Ed. 151 Morningside Drive (Edinburgh).

Wednesday, 20th July.—Discussion: Chronic Sepsis as a Cause of Mental Disorder. To be opened by Dr William Hunter, C.B. (London), followed by Sir Berkeley Moynihan, K.C.M.G., C.B. (Leeds), Dr D. Chalmers Watson (Edinburgh), Dr E. Goodall (Whitchurch), Dr C. H. Bond (Brighton), and Dr W. F. Menzies (Cheddleton).

Thursday, 21st July.—Joint meeting with the Section of Neurology. Discussion: Epidemic Encephalitis.

Friday, 22nd July.—Discussion: Points in the Lunacy Commission on (England) Report—(a) Are the existing safeguards against wrongful detention adequate? (b) How far is judicial intervention necessary in the process of certification? (c) What additional facilities are required for early treatment? To be opened by Professor George M. Robertson (Edinburgh).

Neurology.—*President*: Professor Edwin Bramwell, M.D., F.R.C.P. (Edinburgh). *Local Honorary Secretary*: Norman M. Dott, M.B., F.R.C.S. Ed., 8 Grosvenor Crescent, Edinburgh.

Wednesday, 20th July.—Discussion: The Tics and Allied Conditions. To be opened by Dr S. A. Kinnier Wilson (London), followed by Professor Guillain (Paris), Dr A. F. Hurst (Ascot), Dr A. Stanley Barnes (Birmingham), Dr T. Grainger Stewart (London), Dr Donald E. Core (Manchester), Dr R. G. Gordon (Bath), and Dr W. J. Adie (London).

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Thursday, 21st July.—Joint meeting with Section of Mental Diseases. Discussion: Epidemic Encephalitis.

Ophthalmology.—*President:* A. H. H. Sinclair, M.D., F.R.C.S. Ed. (Edinburgh). *Local Honorary Secretary:* E. H. Cameron, M.B., Ch.B., F.R.C.S. Ed., 7 Darnaway Street, Edinburgh.

Wednesday, 20th July.—10 A.M. Discussion: Optic Neuritis. To be opened by Dr J. V. Paterson (Edinburgh), followed by Dr Henning Rönne (Copenhagen), and Dr A. J. Ballantyne (Glasgow).

Thursday, 21st July.—10 A.M. Papers: Miss I. C. Mann (London), Some Aspects of the Comparative Development of the Retina; Sir W. T. Lister (London), Some Points in Connexion with Detachment of the Retina; Mr W. Clark Souter (Aberdeen), Spontaneous Reattachment of Detached Retina; Sir Arnold Lawson (London), Value of Antiseptics in Modern Ophthalmic Surgery; Mr F. Holt Diggle (Manchester), Relationship between Lachrymal Obstruction and Nasal Disease; Mr H. M. Traquair (Edinburgh), Incidence of Tobacco Amblyopia in Edinburgh and District; Mr A. H. H. Sinclair (Edinburgh), Remarks on Intracapsular Extraction of Cataract, and Demonstration.

Laryngology and Otology.—*President:* A. Logan Turner, M.D., P.R.C.S. Ed. (Edinburgh). *Local Honorary Secretary:* W. T. Gardiner, M.C., M.B., Ch.B., F.R.C.S. Ed., 18 Chester Street, Edinburgh.

Wednesday, 20th July.—Discussion: Neurological and Mechanical Factors underlying Immobility of the Vocal Cords; their diagnosis, prognosis, and principles of treatment. It will be opened by Dr A. Brown Kelly (Glasgow), neurological aspect, and Mr Herbert Tilley (London), mechanical side.

Thursday, 21st July.—Discussion: Otosclerosis. To be opened by Mr G. J. Jenkins (London), followed by Professor F. R. Nager (Zurich) and Dr A. A. Gray (Glasgow). The discussion will be illustrated by microscopical sections showing the changes in the ear in otosclerosis.

Papers: Mr Norman Patterson (London), Some Diseases affecting the Thyro-glossal Tract; Dr Stephen Young (Glasgow), Radiography in Mastoid Disease.

Preventive Medicine.—*President:* Professor P. S. Lelean, C.B., C.M.G., F.R.C.S., D.P.H. (Edinburgh). *Local Honorary Secretary:* W. T. Benson, B.Sc., M.D., D.P.H., M.R.C.P. Ed., City Hospital, Comiston Road, Edinburgh.

Wednesday, 20th July.—10 A.M. Discussion: Should all Public Health Administration—Municipal, School, Factory, etc.—be Concentrated under a Single Department, and the Immediate Control in Each Executive Area be Vested in a Single Individual? To be opened by Sir Leslie MacKenzie (Scottish Board of Health), followed by Dr E. W. Hope (Liverpool), Dr J. H. Meikle (Medical Officer, Edinburgh School Board), Dr A. S. M. Macgregor (M.O.H. Glasgow), and Professor E. L. Collis (Cardiff).

3 to 4 P.M. Demonstration at City Hospital, Comiston Road, Edinburgh, on The Schick and Dick Tests, and Methods of Immunisation against Diphtheria and Scarlet Fever.

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Thursday, 21st July.—10 A.M. Discussion: What Duties has the State in Relation to the Nation's Food Supply regarding Research, Instruction of Parents, Maintenance of Supplies, and Cooking Facilities? To be opened by Professor Edward Mellanby (Sheffield), followed by Dr Eustace Hill (M.O.H. County of Durham), Dr J. P. Kinloch (M.O.H. Aberdeen), and Mr G. Benzie (Motherwell).

12 noon. Paper: Pulmonary Asbestosis (with lantern slides), by Dr W. E. Cooke (Wigan), Sir Thomas Oliver (Newcastle-on-Tyne), and Professor Stuart McDonald (Newcastle-on-Tyne). 2 to 4 p.m. Demonstration: Exhibits in the Museum at the Usher Institute of Public Health, with a special demonstration on food viewed from the popular standpoint.

Physiology and Biochemistry.—*President:* Professor Sir Edward Sharpey-Schafer, M.D., LL.D., D.Sc., F.R.S. (Edinburgh). *Local Honorary Secretary:* Miss May Laurie Walker, B.Sc., M.B., Ch.B., Department of Physiology, University of Edinburgh.

Thursday, 21st July.—Morning session. Discussion: The Structure and Function of the Spleen. To be opened by Professor John Tait (Montreal), followed by Professor J. Barcroft, F.R.S. (Cambridge), and others. Papers: Professor P. T. Herring (St Andrews), The Pineal Gland; Professor D. Murray Lyon and Mr W. Robson, D.Sc. (Edinburgh), Cystinuria; Dr J. Crichton Bramwell (Manchester), Form of the Pulse Wave; Dr J. H. Crawford (Edinburgh), Water Balance in the Human Subject following the Oral Administration of Saline.

Afternoon session. Discussion: The Influence of Internal Secretions on Sex Characters. To be opened by Dr F. A. E. Crew (Edinburgh), followed by Mr A. S. Parkes, D.Sc. (London) and others.

Friday, 22nd July.—Morning session. Discussion: Chemical Changes accompanying Muscular Activity. To be opened by Professor T. H. Milroy (Belfast), followed by Sir F. Gowland Hopkins (Cambridge), Professors O. Meyerhof (Berlin) and G. Embden (Frankfurt). Papers: Professor J. Mellanby (London), Bile as the Alimentary Stimulus for Pancreatic Secretion; Professor J. Tait (Montreal), Natural Arrest of Hæmorrhage from a Wound—illustrated with lantern slides; Professor B. A. McSwiney and Dr H. Whitridge Davies (Leeds), Circulation Rate; Professor R. J. S. McDowall (London), Physiological Considerations in High Blood Pressure; Dr C. R. Harington, Ph.D. (London), The Constitution of Thyroxin.

Afternoon session. Discussion: Hæmolysis. To be opened by Dr Eric H. Ponder (Edinburgh), followed by Professor J. Mellanby, Dr R. Brinkman (Groningen), and others.

Comparative Medicine.—*President:* Principal O. Charnock Bradley, M.D., D.Sc., F.R.C.V.S. (Edinburgh). *Local Honorary Secretary:* J. Russell Grieg, M.R.C.V.S., Royal (Dick) Veterinary College, Edinburgh.

Thursday, 21st July.—(Joint meeting with Section of Pathology and Bacteriology). Discussion: Immunity. To be opened by Dr R. A. O'Brien (Beckenham) and Professor Carl H. Browning (Glasgow), followed by Professor R. Muir (Glasgow), Dr Hedley D. Wright (London),

Edinburgh Meeting, 1927

Colonel W. F. Harvey (Edinburgh), and Professor T. J. Mackie (Edinburgh).

Friday, 22nd July.—(Joint meeting with Section of Pathology and Bacteriology). Discussion: Aspects and Problems of Comparative Medicine. To be opened by Dr Theobald Smith (Princeton, N.J.) and Professor Basil Buxton (Cambridge, followed by Major G. W. Dunkin (London), Dr W. H. Andrews (Ministry of Agriculture), Dr F. A. E. Crew (Edinburgh), Dr H. H. Scott (London), Professor Leiper (London), Mr J. W. Brittlebank (London), Mr Arthur Gofton (Edinburgh), Mr T. W. M. Cameron (London), and Mr James McAllan (Aberdeen).

Dermatology.—*President:* Robert Cranston Low, M.D., F.R.C.P. Ed. (Edinburgh). *Local Honorary Secretary:* Robert Aitken, M.D., F.R.C.P. Ed., 8 Palmerston Place, Edinburgh.

Thursday, 21st July.—Discussion: The Uses and Limitations of Ultra-violet Radiations in Dermatology.

Tropical Diseases.—*President:* Andrew Balfour, C.B., C.M.G., M.D., F.R.C.P. Ed., D.P.H. (London). *Honorary Secretary:* A. R. D. Adams, M.B., Ch.B., D.T.M., School of Tropical Medicine, University of Liverpool.

Wednesday, 20th July.—10 to 11 A.M. Discussions: (1) Amœbic Dysentery. To be opened by Professor Warrington Yorke (Liverpool), followed by Dr P. H. Manson-Bahr (London) (Treatment and Epidiascopic Illustrations of Sigmoidoscope Appearances).

11 A.M. to 1 P.M. (2) Some Problems of Malaria Prophylaxis. To be opened by Lieut.-Colonel S. P. James (Ministry of Health).

Afternoon. Museum Demonstration. Professor W. Yorke and Dr A. R. D. Adams, Amœbic Dysentery. There will also be a demonstration of material lent by Professor W. S. Patton (Liverpool).

Forensic Medicine.—*President:* Professor H. Harvey Littlejohn, M.B., F.R.C.S. Ed. (Edinburgh). *Local Honorary Secretary:* D. J. A. Kerr, M.B., Ch.B., D.P.H., M.R.C.P. Ed., Forensic Medicine Department, University, Edinburgh.

Thursday, 21st July.—Discussions: (1) Alcohol and the Motorist. To be opened by Dr G. Carter (Sheffield). (2) The Police Surgeon in Relation to Forensic Medicine. To be opened by Professor J. Glaister (Glasgow).

Demonstrations: In connexion with the Section arrangements are being made for a demonstration of the museum of the Forensic Medicine Department, Edinburgh University, and of subjects of special medico-legal interest.

Tuberculosis.—*President:* S. Vere Pearson, M.D. (Mundesley). *Local Honorary Secretary:* J. C. Simpson, M.C., M.B., Ch.B., D.P.H., Southfield Sanatorium Colony, Liberton, Edinburgh.

Friday, 22nd July.—10 A.M. Discussions: (1) Radiology and Diagnosis of Intrathoracic Tuberculosis from the Point of View of Specialist and Practitioner. To be opened by Mr H. Morriston Davies (Vale of Clwyd Sanatorium, North Wales), followed by Dr E. Rist (Paris), Dr J. Logan

British Medical Association

Stewart (Manchester), and Dr J. M. Woodburn Morison (Edinburgh) (2) Pathology of the Tuberculosis of Childhood and its Bearing on Clinical Work. To be opened by Professor Eugene L. Opie (Washington University), followed by Dr R. G. Canti (London) and Dr P. F. Armand-Delille (Paris). (3) Interrelation of Physician and Surgeon in Regard to Non-pulmonary Tuberculosis. To be opened by Dr D. A. Powell (Cardiff) and Professor John Fraser (Edinburgh), followed by Dr G. H. Girdlestone (Oxford).

2.30 P.M. Demonstrations, X-rays, etc.

Venereal Diseases.—*President:* David Lees, D.S.O., M.B., F.R.C.S. Ed. (Edinburgh). *Local Honorary Secretary:* Miss Mary Forbes Liston, M.B., Ch.B., 33 Comely Bank, Edinburgh.

Friday, 22nd July.—Morning session. Discussion: The Value of Routine Examination of the Cerebro-spinal Fluid with regard to (a) More Accurate Knowledge, (b) Prognosis, (c) Treatment. To be opened by Mr C. H. Mills (London). Clinical cases illustrating types of neuro-syphilis will also be shown.

Afternoon session. Discussions: (1) The Employment of Certain Constituents of the Gonococcus in Treatment and of other Constituents in Tests of Cure. To be opened by Major E. C. Lambkin, D.S.O., R.A.M.C.; (2) The Place of Bismuth in the Treatment of Syphilis, by Mr David Lees, D.S.O.

Radiology.—*President:* J. M. Woodburn Morison, M.D., C.M., D.M.R.E. (Edinburgh). *Local Honorary Secretary:* W. Crichton Fothergill, M.B., Ch.B., D.M.R.E., 5 Hermitage Drive, Edinburgh.

Wednesday, 20th July.—Discussions: (1) 10 A.M. X-rays in the Diagnosis of Intrathoracic Growth. To be opened by Dr Robert Knox (London), followed by Mr C. Thurstan Holland (Liverpool), Dr A. Fergus Hewat (Edinburgh), Dr Stanley Melville (London), and Dr D. Campbell Suttie (Glasgow). (2) 11.30 A.M. X-rays and Radium in the Treatment of Carcinoma of the Breast. To be opened by Dr N. S. Finzi (London), followed by Dr J. H. D. Webster (London), Dr A. E. Barclay (Manchester), Dr M. R. J. Hayes (Dublin), and Dr R. Knox (London).

History of Medicine.—*President:* John D. Comrie, B.Sc., M.D., F.R.C.P. Ed. (Edinburgh). *Local Honorary Secretary:* Adam Cairns White, M.B., Ch.B. Ed., Pharmacological Department, University of Edinburgh.

Friday, 22nd July.—10 A.M. Discussion: The Historic Evolution of Disease. To be opened by Sir Humphry Rolleston, Bt. (Cambridge), followed by Professor Grafton Elliot Smith (London) Ancient Prototypes of Modern Disease, Dr G. Matheson Cullen (Edinburgh) World Epidemics and their Relationship in Cause and Effect to Social Conditions, and Miss M. C. Buer (Reading) The Effect of Early Industrialism upon the Health of the Community.

Papers: 12.15 P.M., Professor A. J. Clark (Edinburgh), The Historical Aspect of Quackery. 12.30 P.M., Professor W. J. Dilling (Liverpool), The Methods of Introduction of Drugs.

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Demonstrations: (1) Dr Arnold Chaplin (London), Portraits of Old Physicians; (2) Mr G. H. Edington (Glasgow), The Development of Surgery up to the Time of Lister.

Medical Sociology.—*President*: F. N. Kay Menzies, M.D., F.R.C.P. Ed., D.P.H. (London). *Local Honorary Secretary*: T. Yule Finlay, M.D., M.R.C.P. Ed., 9 Hermitage Gardens, Edinburgh.

Friday, 22nd July.—Discussion: The Future Relationship of Municipalities to the Voluntary Hospitals of this Country. To be opened by Mr H. L. Eason (London) and Mr M. A. Reynard (Glasgow Parish Council), followed by Sir Henry Keith, Sir Arthur Stanley, and others.

Arrangements for Ladies.—The Assembly Rooms in George Street have been taken for a ladies' club during the meeting. There will be a library and writing room, containing daily papers and books of local interest. An ample catering department will be established where lunch, tea, and light refreshments may be obtained. There will also be a central information bureau. During the mornings of the meeting, short excursions for ladies will take place in and around Edinburgh. Parties of ladies will also be taken in the mornings to places of special interest in Edinburgh. Arrangements for ladies' sports have been undertaken, and parties will be made up for golf and tennis. Full details as to excursions, personally conducted tours, and sports will be obtainable at the Ladies' Club.

The Annual Exhibition.—The Annual Exhibition of surgical appliances, foods, drugs, books, engravings, etchings, etc., to be held in the Waverley Market, Princes Street, Edinburgh, will be open for inspection on Monday, 18th July, from 2 till 6 P.M.; the formal opening by the President will take place on 19th July at 9.30 A.M. The exhibition will remain open on 20th, 21st, and 22nd July from 9 A.M. to 6 P.M.

Full particulars are published from time to time in the *British Medical Journal*.

THE ACTION OF URINARY ANTISEPTICS.

By RALPH STOCKMAN, M.D., Professor of Materia Medica and Therapeutics, University of Glasgow.

THE treatment of infections of the genito-urinary tract by means of medicines administered by the mouth presents many inherent difficulties, and only very little help in overcoming these can be got from the kind of information yielded by experiments carried out with test-tubes and bacterial cultures. The conditions in the two cases are so widely different that the real value of any remedy can only be gauged from clinical experience of it. In the first place it is impracticable to administer to patients very powerful germicidal poisons to be excreted in the urine, and those which we can use are so chemically altered and detoxicated in the body that they reach the urine in a greatly weakened form. Further, fresh supplies of active living organisms are constantly contributed from the deeper tissues of the infected urinary passages, or from the prostate or seminal vesicles, or from other places to which the drugs may hardly penetrate, and thus the infection may be kept up and renewed indefinitely. Further, once the urine is infected it forms a favourable culture medium which is continually being reinforced by the blood, pus, and general organic debris usually present, and these elements may in addition adsorb and bind a considerable part of the remedy and thus further diminish its effective action on the bacteria. The formation of ammonia from urea in some cases and the obscure chemical interchanges always going on among the urinary salts must also constitute a disturbing factor, while frequent emptying of the bladder may leave from time to time a quite inadequate supply of the drug to cope successfully with the bacterial growth. Like many of our most trusted remedies, such as digitalis, potassium iodide, arsenic, and quinine, for example, urinary antiseptics show their desired effects only under conditions of disease, and these effects could not have been deduced from a study of their action on healthy men or animals. Most of these disturbing elements are absent in observations carried out with test-tubes, and hence the problems connected with the real practical value of urinary antiseptic drugs must depend on clinical rather than laboratory solution. There are other considerations which further accentuate the

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The Action of Urinary Antiseptics

differences. The kidney normally excretes from the blood-stream coliform and other organisms, and healthy urine and urinary passages seem to be very immune to infection from this source; but the presence of any local organic lesion at once weakens the immunity and at the same time renders treatment much less effective and more difficult to carry out. It is, therefore, an essential part of any drug treatment to deal as radically as possible with enlarged prostate, urethral stricture, stone, or any other lesion which may be present. Another great and important element of success is early treatment in order to prevent deep infection of the tissues, and equally important is prolonged treatment carried out until the infection is eradicated and not merely ameliorated. I have often noticed that when *B. coli* and staphylococcic infections of the bladder have become chronic there occurs almost complete local immunity, so that the patient experiences no discomfort although the urine may be swarming with organisms; and owing to there being no complaint and no symptoms these cases are frequently overlooked. It is often difficult to induce such patients to persevere with treatment, although it is very essential they should do so, as there is always present a greater or lesser amount of systemic poisoning besides the risk of exacerbations. Such individuals never feel in robust health, they lose energy and brightness, and in time always become victims to fibrositis.

The usual organisms which we have to combat are the *B. tuberculosis*, *B. coli*, staphylococci, gonococcus, and *B. typhosus*. Of these *B. coli*, alone or mixed, is by far the most frequent, streptococcal infection is not very common, and the *B. proteus*, leptothrix, sarcina and yeast are extremely rare. The *B. tuberculosis* I do not propose to consider here as no known urinary antiseptic has any effect upon it.

At the outset we have to make up our minds that we do not as yet possess a perfect urinary antiseptic, nor even a very powerful one, and my object in writing this paper is to try to define more clearly the action and value of those most commonly used and so lead to their more accurate application in individual cases. A reliable and efficient bactericidal drug is especially very much needed for treating children, and to avoid the troublesome and objectionable use of instruments in adults.

Before considering the various substances in detail, I wish

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to advert briefly to one method which has sometimes been relied on to determine their efficacy, and which I have found very fallacious as a test, namely, the observation of the time within which ammoniacal decomposition sets in after the urine has been voided.

Ammoniacal Decomposition of the Urine.

In estimating the value of urinary antiseptics weight has sometimes been laid on the length of time the urine resists ammoniacal decomposition after it has been passed. This, however, is a very uncertain criterion and has no definite value in settling the matter, as the following simple observations serve to demonstrate. When samples of urine of ordinary normal acidity are passed into urine glasses which have been sterilised in boiling water and the uncovered glasses, freely exposed to the air, are kept standing on a laboratory table, it is found that very varying times elapse before the different samples become alkaline and ammoniacal with a free growth of organisms in them. In very numerous observations the time was found to vary from two to twenty-nine days, the majority taking roughly about ten to fifteen days, while a few remained acid indefinitely. When the vessels were loosely covered over with paper decomposition was as a rule delayed, and when they were plugged with cotton-wool the urine remained sterile. If the urine glasses were merely rinsed with water or were kept in the hospital test-room decomposition set in more rapidly than when strict cleanliness was observed. The conclusion must be drawn that the onset of decomposition depends on the time and extent to which any particular glass of urine happens to become contaminated by urea-splitting organisms. Cocci grow scantily in acid as compared with alkaline urines, and it is only when alkalinity sets in that a really abundant growth takes place. The ammonium carbonate which the organisms set free from urea has to neutralise the acidity of the urine before this occurs, and it is on this account that strongly acid urines resist ammoniacal decomposition longer than feebly acid or alkaline ones do. It was found, moreover, that highly acid urines often decomposed more quickly than the less acid. There was no regularity in time or in degree of acidity in the matter, and it seemed to depend entirely on the chances of contamination. Urines

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which are alkaline when passed resist decomposition for about four days at most. A really powerful urinary antiseptic would of course inhibit bacterial growth in voided urine, but no such substance is yet known, and it was found that the urine of persons taking copaiba, benzoates, salicylates, acid sodium phosphate, and other substances decomposed in the same irregular and uncertain manner as normal urines do and within the same limits of time. This does not necessarily imply that these drugs have no retarding effect on bacterial growth and ammoniacal decomposition in the urine, it simply means that one cannot estimate the value of a comparatively weak urinary antiseptic by observation of the time required for the urine to decompose after it has been passed, which is always very irregular and seems to be largely a matter of chance contamination. Similar observations made with urines kept in an incubator at body temperature gave similar results, and in these to prevent rapid evaporation the urine glasses were loosely covered with watch-glasses.

Acid Sodium Phosphate (NaH_2PO_4).

Since it was first recommended by Hutchison, acid sodium phosphate has been largely used in practice to increase the acidity of the urine. On the ground that it is the natural acidifying agent of the urine, it is very generally assumed that one has only to increase the dose and the urine becomes proportionately more acid. This, however, is far from being the true state of matters. Part of it only, perhaps one-half, becomes absorbed from the bowel, and after this has encountered the alkaline contents of the duodenum and been absorbed into the alkaline blood and subjected to the selective eliminating action of the kidneys, the proportion of it which emerges as the acid phosphate of sodium varies so much that the extent of its influence on the total acidity of the urine is an inconstant and uncertain quantity. In the duodenum and blood more or less of it may be converted into the alkaline di-sodium phosphate (Na_2HPO_4), and this may again be partly dissociated into the acid mono-sodium phosphate (NaH_2PO_4) and so excreted in the urine. The chemical interchange is represented by the equation $\text{Na}_2\text{HPO}_4 + \text{H}_2\text{O} \rightleftharpoons \text{Na} - \text{HO} + \text{NaH}_2\text{PO}_4$.

Miss J. Small, Carnegie Research Scholar, made gravimetric determinations of the total P_2O_5 excreted in the urine of a

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person on fixed diet who took 120 grains (8 grams) acid sodium phosphate in one day. The average amount of P_2O_5 on the two preceding days was 1.337 grams, on the third day (the day on which the drug was taken) it rose to 3.376 grams, on the fourth day it was 2.406 grams, and on the fifth day 1.686 grams. Thus 51 per cent. of it was absorbed and the remainder excreted in the fæces. The acid phosphate in relation to the alkaline phosphate was exactly doubled in amount during the first twenty-four hours, and by the third day had returned to its previous level.

Under normal conditions of health the hydrogen ion concentration (reaction) of the body fluids is kept remarkably constant, that of the blood being about pH 7.4 (faintly alkaline) and of the urine round about pH 6 (slightly acid), 7 representing neutrality. The possible limits of change in reaction are therefore small, and this is brought about by the "buffer" effect of the sodium bicarbonate, phosphates, amino-acids, proteins, and other substances in the blood-plasma, which greatly slow and discourage chemical action and prevent sudden or extreme changes taking place in its chemical composition. It is necessary for the proper functioning of the body cells that they should be kept bathed in a faintly alkaline medium, and that too high a degree of acidity or alkalinity be prevented. The kidneys play an important part in accomplishing this balance, they actively excrete foreign and excess substances, and they maintain the healthy normal composition and reaction of the blood by eliminating acid bodies and retaining in the blood as much alkali as it requires, their activities in this respect being confined almost entirely to changing the weakly alkaline mixture of phosphate salts in the blood to the more decidedly acid mixture of phosphates in the urine. The relative amounts of the acid mono-sodium phosphate and the alkaline di-sodium phosphate in the blood are constantly, therefore, undergoing modification according to the passing needs of the blood to maintain its normal alkalinity against the intake of acid or alkaline substances, and this in turn is reflected in the relative proportions of these two salts in the urine, and its consequent titrable acidity (with $NaOH$). Acid phosphate of sodium is a very soluble salt, it is rapidly absorbed and rapidly excreted, hence the effects of its administration or stoppage are very fully apparent in the urine in a few hours. In large doses (half-ounce daily or less) it may cause diarrhoea, and this disturbs the composition of the urine apart from any strictly chemical effect it may exercise. Its purgative action is irregular and probably depends on the extent to which it is converted into the di-sodium phosphate in the upper bowel.

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It has to be clearly borne in mind that the "true acidity" or "hydrogen ion concentration" of the urine is a matter quite distinct from its "total acidity." The latter is measured by titrating a small portion of the twenty-four hours' urine with deci-normal NaOH. There are no free acids in normal urine and the NaOH simply determines the quantity of acid phosphates (sodium, calcium, etc.), or other acid salts present, by combining with them and satisfying their chemical affinities. It in no way determines the "true acidity" or "hydrogen ion concentration." This depends on the number of dissociated H ions present in the urine, and the buffering action of the mixture of urinary salts always prevents any very high degree of such dissociation. But it is the number of dissociated or free H ions (the hydrogen ion concentration) which determines the real active acidity of a solution, and the titrable acidity with NaOH gives no information about this.

The true reaction of a solution depends on the relative amounts (or concentration) in it of hydrogen ions ($\overset{+}{H}$) and hydroxyl ions (OH^-). When these are equal the solution is neutral, when the $\overset{+}{H}$ ions are in excess it is acid, and when the OH^- ions are in excess it is alkaline. A "strong" acid, such as HCl, is one which dissociates freely in a solution and a "weak" acid, such as H_3PO_4 , is one which dissociates feebly, and the same holds true of "strong" and "weak" bases. Even in a watery solution acid sodium phosphate dissociates very slightly, and in a complex buffer mixture like the urine the tendency is still further and greatly reduced. Hence urine never attains a high degree of true acidity by dissociation of its natural acidifying agent, and even when the titrable acidity is greatly raised by giving acid sodium phosphate the real acidity may remain unchanged (*Experiment IV*). It is only free electrically charged ions which are active in determining acidity or alkalinity, undissociated H or OH ions in a solution have no effect.

Hydrogen ion concentration is now for convenience generally expressed as a logarithm pH , pH_7 representing neutrality, under 7 acidity, and over 7 alkalinity. It can be measured by an electrical apparatus which determines the conducting power of the solution, but the ordinary method, which is sufficiently accurate for most purposes, is to use a series of "indicators," each of which changes colour within a narrow range of H ion concentration. All my determinations were made in this latter way. The total acidity was determined by titrating with a deci-normal solution of NaOH, with phenolphthalein as an indicator, using the correction for the varying specific gravities of different samples of urine which was suggested by Joulie and employed by Jordan in his research on urinary antiseptics.

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This method gives the titrable acidity in terms of total solids, and not of the bulk of fluid, that is, it eliminates the effect of a dilute or concentrated urine.

I. Effect of Acid Sodium Phosphate on the Total Acidity of the Urine.—The usual effect is to raise the total acidity, but always in a varying and irregular degree. Sometimes it may even fall at first, and often in the same individual a large dose has a lesser influence in raising it than a smaller dose.

EXPERIMENT I.

Three healthy men on a nearly uniform diet. The urine of twenty-four hours was collected and its total acidity determined by titration with deci-normal NaOH and phenolphthalein.

| Day. | I. | II. | III. | |
|-----------|-----|-----|------|---|
| 1 | 3.1 | 2.3 | 3.6 | No drug. |
| 2 | 2.8 | 4.6 | 1.8 | |
| 3 | 3.4 | 2.2 | 2.0 | |
| 4 | 3.9 | 4.0 | 2.5 | |
| 5 | 3.4 | 3.6 | 2.5 | |
| 6 | 4.0 | 3.4 | 2.5 | |
| Average . | 3.4 | 3.3 | 2.5 | At 12 noon Acid Sod. Phos. 40 gr. six times daily (16 grams). |
| 7 | 4.6 | 4.0 | 3.0 | |
| 8 | 6.1 | 6.1 | 4.9 | |
| 9 | 5.8 | 6.6 | 4.7 | |
| 10 | 6.4 | 7.2 | 3.5 | |
| 11 | 5.2 | 7.3 | 1.6 | |
| Average . | 5.6 | 6.2 | 3.5 | Drug stopped at 12 noon. |
| 12 | 4.0 | 5.7 | 3.1 | |
| 13 | 2.1 | 3.7 | 2.6 | |
| 14 | 3.2 | 3.9 | 2.3 | |
| 15 | 3.2 | 2.5 | 2.8 | |
| Average . | 3.2 | 3.9 | 2.7 | |

There is no fixed proportion, therefore, between the amount taken by the mouth and the degree of titrable acidity of the urine. These points are all clearly brought out in the following observations (*Experiments I and II*). From these it is very evident that as a rule more or less of the acid sodium phosphate is excreted as such, and raises the total acidity of the urine as estimated by titration with an alkali; but the rise is not necessarily in proportion to the quantity taken by the mouth, as the amount in the urine is really determined by the needs of the blood-plasma for the time being.

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In *Experiment II* 40 grains six times daily had a greater effect in raising the total acidity than 80 grains six times daily in all three men, and there was no diarrhoea with the larger doses to disturb the result.

EXPERIMENT II.

Three healthy men under the same conditions as in Experiment I.

| Day. | I. | II. | III. | |
|------|-----|-----|------|--|
| 1 | 4.3 | 3.1 | 1.1 | No drug. |
| 2 | 3.2 | 3.3 | 5.1 | Acid Sod. Phos. 10 gr. thrice daily (2 grams). |
| 3 | 3.0 | 2.7 | 4.2 | 20 gr. thrice daily (4 grams). |
| 4 | 3.1 | 2.7 | 4.2 | |
| 5 | 3.5 | 3.5 | 3.8 | |
| 6 | 5.5 | 3.5 | 2.0 | 40 gr. six times daily (16 grams). |
| 7 | 5.6 | 3.6 | 5.0 | |
| 8 | 5.8 | 5.0 | 7.0 | |
| 9 | 5.1 | 4.2 | 6.2 | 80 gr. six times daily (32 grams). |
| 10 | 5.7 | ... | 4.5 | |
| 11 | 4.3 | 4.2 | 3.8 | |
| 12 | ... | 2.6 | 3.1 | No drug. |
| 13 | 2.8 | 4.5 | 4.7 | |
| 14 | 3.0 | 3.8 | 1.8 | |
| 15 | 4.3 | 2.7 | 2.9 | |
| 16 | 3.8 | 2.4 | 1.8 | |
| 17 | 3.6 | 3.8 | 0.9 | |

2. Effect of Acid Sodium Phosphate on the Hydrogen Ion Concentration of the Urine.—It was found that the administration of acid sodium phosphate by the mouth had practically no effect on the hydrogen ion concentration of twenty-four hours' normal acid urine (*Experiment III*). A large number of observations were made on healthy men with very varying doses; but the result was always the same, and is due to the buffer action of the mixture of salts in the urine. In several cases the total acidity by titration with NaOH and the hydrogen ion concentration (true acidity) were determined simultaneously, and it was found that while the former was augmented the latter remained unaffected (*Experiment IV*).

As a check on these results quantities of $\frac{1}{2}$ to 2 grains of acid phosphate of sodium were added to 1 oz. of fresh normal urine. The total acidity always rose proportionately while the pH remained quite unchanged. When water was used instead of urine, total acidity and pH both showed increased acid values. This demonstrated the powerful buffer effect of the mixture of salts in the urine in inhibiting any marked increase in hydrogen ion concentration. Henderson and

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Palmer by giving 10 grams (150 grains) acid sodium phosphate in one dose got a slight rise in the hydrogen ion concentration, but "only slightly greater than that which occurs in normal cases without mono-sodium phosphate intake." It is not practicable, however, to give such large quantities at one dose to patients, and they cannot as a rule be kept up without causing diarrhoea.

EXPERIMENT III.

Two healthy men on a nearly uniform diet. The acidity (pH) was determined by "indicators."

| Day. | I. pH. | II. pH | |
|-----------|---|--------|--|
| 1 | 6.1 No drug | 5.5 | No drug. |
| 2 | 6.1 | 5.4 | |
| 3 | 6.3 | 5.7 | |
| 4 | 6.1 | 5.5 | Average 5.5. |
| 5 | 5.0 | 5.7 | Acid Sod. Phos. 20 gr. thrice daily (4 grams). |
| Average . | 5.9 | | |
| 6 | Acid Sod. Phos. 10 gr. thrice daily (2 grams) | 6.5 | Average 6.1. |
| 7 | 6.2 | 5.8 | 40 gr. thrice daily (8 grams). |
| 8 | 5.4 | 5.4 | |
| 9 | 5.4 | 5.5 | |
| 10 | 5.9 | 5.1 | |
| 11 | 6.2 | 5.4 | Average 5.4. |
| 12 | 6.1 | 5.8 | 40 gr. six times daily (16 grams). |
| 13 | 6.4 | 5.6 | |
| 14 | 6.2 | 5.8 | Average 5.4. |
| Average . | 5.9 | | |

EXPERIMENT IV.

Healthy man on nearly uniform diet.

| Day. | pH. | Total Acidity by NaOH. | |
|------|-----|------------------------|--|
| 1 | 6.1 | 4.1 | No drug. |
| 2 | 6.3 | 5.6 | |
| 3 | 6.4 | 3.5 | |
| 4 | 6.1 | 4.8 | |
| 5 | 6.1 | 4.2 | Acid Sod. Phos. 40 gr. thrice daily (8 grams). |
| 6 | 6.1 | 7.6 | |
| 7 | 6.1 | 8.9 | |
| 8 | 6.1 | 3.5 | No drug. |
| 9 | 6.3 | 3.4 | |
| 10 | 6.6 | 1.8 | |
| 11 | 6.7 | 0.76 | |
| 12 | 6.6 | 1.8 | |

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The Action of Urinary Antiseptics

Clinical Uses.—In cases which show a persistent mild alkaline reaction of the urine and consequent precipitation of earthy phosphates and carbonates within the urinary passages, the administration of acid sodium phosphate gets rid of the condition by providing an acid salt which can combine with and neutralise the excess of alkali. The deposit of earthy salts and possible formation of calculi can thus be guarded against. Enough should be given to produce distinct acidity of the urine to litmus paper.

It may also be given with great advantage when *slight* ammoniacal decomposition is going on in the bladder from bacterial infection. In acid urine the micrococcus ureæ and other ammonia-forming organisms grow with difficulty until they succeed in turning the urine ammoniacal, when they at once begin to flourish much more luxuriantly, or expressed otherwise, it is well recognised that acid urines do not putrefy so readily as alkaline ones. The acid phosphate combines with the ammonia to form sodium-ammonium phosphate, and if in sufficient amount may thus succeed in keeping the urine acid and lessening the tendency to its decomposition from bacterial growth. Its action can be greatly supplemented by hexamine or boric acid. In very ammoniacal urines its action in this direction is not effective, as it is never in sufficient quantity to neutralise all the free ammonia present, and the urine remains ammoniacal. Boric acid or ammonium benzoate should be given in addition, as hexamine has no action so long as the urine remains alkaline. If the sepsis still persists the bladder should be washed out regularly with boric lotion to lessen the ammonia, bacteria, and pus, and so give the acid phosphate whatever chance it may have to overcome the alkalinity of the urine. Before and after operations on the urinary passages it may be given to maintain the total acidity of the urine and thus discourage bacterial growth in it.

At the present time it is perhaps most frequently prescribed along with hexamine under the idea that by increasing the total acidity of the urine the hexamine splits off a larger amount of formaldehyde than it would otherwise do. If the urine is slightly alkaline or of low acidity this does happen, provided it succeeds in turning the urine distinctly acid. But when the urine is already markedly acid the administration of acid sodium phosphate has no effect in increasing its hydrogen ion concentration, owing to the complete buffering action of the

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complex mixture of salts present in it. Hence with a urine already frankly acid to litmus it is unnecessary to give it along with hexamine. As long as the urine keeps definitely on the acid side of pH_7 , it splits off formaldehyde from hexamine, and at the same time neutralises the ammonia which is also given off in the process, and the administration of more acid sodium phosphate may not be required to increase the activity of the urine in these respects. Nevertheless, in order to neutralise the "alkaline tide" after meals and to keep the urine on the safe side as regards acidity, it is usually good practice to give it along with hexamine in these circumstances.

In cases of *B. coli* cystitis with an acid reaction of the urine to litmus and pus present, it is often impossible to increase the total acidity of the urine by giving acid sodium phosphate. The following case serves as an illustration of this. The explanation must lie in the occurrence of obscure chemical changes which are difficult to follow out and explain.

Woman, 45.—Urine acid to litmus and containing coliform organisms and much pus. Has been taking 10 grains hexamine thrice daily and there is a marked formaldehyde reaction in the urine.

| Day. | Total Acidity by NaOH. | |
|------|---------------------------|--------------------------------------|
| 1 | 2.3 | Acid Sod. Phos. 20 gr. thrice daily. |
| 3 | 2.5 | |
| 6 | 1.7 | |
| 11 | 1.5 | |
| 12 | ... | |
| 14 | 2.0 | |
| 17 | 1.5 | |
| 19 | 3.1 | |
| 21 | 2.0 | |
| 25 | 2.2 | |
| 27 | 2.4 | 40 gr. thrice daily. |
| 31 | 2.0 | |
| 33 | 1.7 | |
| 34 | 4.5 | |
| 36 | 2.2 | |
| 37 | 1.0 | |
| 38 | 1.7 | |

Even in cases where the urine is faintly alkaline or neutral I have also sometimes found it impossible to raise the total acidity by giving ordinary doses (40 grains four times daily) of acid phosphate of sodium.

The Action of Urinary Antiseptics

Benzoic Acid and Benzoates.

It has been recognised since the time of Berzelius (1813) that the ordinary mineral and vegetable acids do not neutralise or make acid an alkaline urine, a finding which was confirmed by Magendie in 1818 and by Wochler in 1824, the explanation in the case of the mineral acids being that flesh-eating animals can always furnish abundance of ammonia to combine with them, and thus protect the alkali of the blood and prevent it being drawn upon and dangerously diminished. The mineral acids are therefore excreted in the urine as neutral salts of ammonium or other alkalies, and in consequence do not increase its acidity. In the case of the common vegetable acids (acetic, tartaric, citric) and their salts, Gilbert Blane pointed out in 1808 that potassium acetate or citrate alkalise the urine as effectually as the corresponding carbonate or bicarbonate, and in 1824 Wochler showed that they are oxidised in the body and excreted as alkaline carbonates and thus act as alkalinisers of the urine. Benzoic acid (C_6H_5COOH) and benzoates, on the other hand, are capable of acidifying a neutral or alkaline urine, and they do this in virtue of the benzoic acid being synthesised in the kidney to hippuric acid which takes up alkali and is excreted in the urine as a hippurate. This was first observed by Alex. Ure in 1841. Shortly afterwards Dessaignes showed that the hippuric acid is formed by the combination of benzoic acid with glycocoll, and in 1877 Bunge and Schmiedeberg proved experimentally that the synthesis takes place in the kidney. Alex. Ure was also the first to use benzoic acid for the purpose of rendering alkaline urines acid and of preventing the deposit of earthy phosphates, and he recognised that it "solved the hitherto embarrassing problem of making an alkaline urine acid," remarking at the same time that it is always easy to make an acid urine alkaline. Following him Walker reported four cases of *dysuria scillitis* with ammoniacal urine in which an emulsion of benzoic acid and copaiba cleared up the urine successfully. Later (1874) Gosselin and Robin, using benzoic acid and ammonium or sodium benzoate, emphasised their value in a series of cases of ammoniacal cystitis, stating that the urine became acid or neutral in five to nineteen days, and that the amounts of pus, blood, and phosphatic deposit were greatly diminished. They also advised that a course of such treatment should be given previous to any operative interference in these cases.

When ammonium benzoate is taken by healthy men in 20-grain doses thrice daily, I find that little or none of the benzoic acid escapes conversion into hippuric acid of which it will yield nearly 90 grains in the urine, and its excretion begins in about half an hour or even less. The ammonium part of it is converted into urea in the body, and thus has no effect in increasing the alkalinity of the urine, while the benzoic or hippuric half is left free to combine with alkali which it carries out of the body through the kidneys. The hippuric acid is thus excreted not as the uncombined acid but as an alkali salt—a hippurate—neutral in reaction, and therefore incapable of any direct effect in increasing the acidity of the urine. It has, however, a marked indirect effect by taking up so much alkali that the relative proportions of the alkaline Na_2HPO_4 and the acid NaH_2PO_4 are altered in favour of the latter, thus increasing the urinary acidity. Miss Small determined for me the amount of P_2O_5 in the urine of a person on fixed diet before and after taking 60 grains daily (4 grams) ammonium benzoate for two days. The normal average amount was 1.1317 grams per day, and on taking the drug it rose to 1.5995 grams, 1.542 grams, and 1.645 grams, while the proportions of acid to alkaline phosphate was also considerably increased. In this way doses of 60 to 75 grains of ammonium benzoate per day ensure a higher titrable acidity of the urine (due to NaH_2PO_4), which therefore does not readily become ammoniacal; but organisms grow in it after voiding as freely at least as they grow in other acid urines, and the degree of acidity never exceeds that of normal acid urines. It therefore confers little or no antiseptic action on the urine beyond what is attributable to the acidity. As long ago as 1858, Kerner noticed that the administration of benzoic acid did not raise the acidity beyond normal limits, and Johnston found that in persons with normally acid urines ammonium benzoate was also ineffective in doing so, but that when the urine was weakly acid or alkaline in reaction it then raised the total acid output. He also found that in no case, whether the urine was alkaline or acid, did it raise the pH acidity beyond the ordinary limits of normal acid urine. Any increase of urinary acidity which it may bring about is, therefore, not a direct matter of the presence of benzoic or hippuric acid, but of acid sodium phosphate. Hippuric acid and alkaline hippurates are practically inert substances. They have no action on the common septic microbes or on yeast, but in an

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alkaline or putrefying ammoniacal urine the hippuric acid is split up by the same organisms which decompose urea (van Tieghem) and again yields benzoate which has a slight antiseptic action. Johnston has also shown that with the continuous administration of ammonium benzoate a small amount of unconjugated benzoic acid begins to appear in the urine (as a benzoate) and according to his experimental results this is capable of exercising a certain slight inhibitory effect on the growth of *B. coli*, but not of strepto- or staphylococci. The outstanding action of ammonium benzoate, however, lies in its power of acidifying an alkaline urine by determining an increase in the amount of acid sodium phosphate.

Clinical Uses.—The therapeutical value of benzoic acid and benzoates as urinary antiseptics only comes into play when the urine is weakly acid or alkaline, and more especially when it is septic and ammoniacal. If by their administration the urine can be rendered acid in reaction septic bacterial growth and activity are at once lessened, the ammonia split off from urea by microbic action combines with the acid salts present, and the acid urine secreted by the kidney is then no longer neutralised by the ammonia in the bladder and recovers its normal acid reaction. As soon as this occurs the earthy phosphates cease to be precipitated, pus and mucus and epithelial debris gradually diminish in amount as the bacterial activity lessens, and the urine becomes clear or at least much clearer. In some cases the result is entirely successful, in most only partially so. As long as the urine remains alkaline acid sodium phosphate or boric acid may be given to assist the action of the benzoate, and once the urine is frankly acid hexamine may be also given. In cases of slightly alkaline urine with phosphaturia ammonium benzoate usually clears up the urine in a short time, and may thus prevent the formation of phosphatic calculi.

In *B. coli* infection the urine is almost invariably acid in reaction, and ammonium benzoate is incapable of raising its acidity to a degree which is inhibitory to the growth of coliform organisms; but according to Johnston the unconjugated benzoate which is usually present does exercise a very slight inhibitory effect on the organisms. On the whole, however, it is probable that benzoates have little effect in getting rid of a *B. coli* infection.

Clinical experience has shown that benzoates are of no value in typhoid, tubercle, or gonococcus infections. They can

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also have little effect in pyelitis as they traverse the pelvis of the kidney chiefly as inert hippurates.

When it is desired to render an alkaline urine acid ammonium benzoate is a better salt to use than sodium benzoate. A much smaller amount is required as the ammonium ion is converted into urea by the liver, leaving the benzoic acid free to form new sodium or potassium salts and this, by diminishing the alkalinity of the blood-plasma, encourages the excretion from it of the acid sodium phosphate in order to maintain its normal degree of alkaline reaction. With sodium benzoate, on the other hand, a considerable amount of alkali is introduced into the body, and in order to neutralise it the acid substances present in the blood are drawn upon and diminished. Nevertheless, large doses of sodium benzoate are very effectual in acidifying the urine and are almost non-toxic.

Salicylic Acid and Salicylates.

Salicylates are sometimes mentioned in text-books as exerting an antiseptic action in the urine, but in actual practice they are very little used for this purpose. Their effect is similar to that of benzoates, namely, by withdrawing alkali from the blood they tend to increase the proportion of acid salts in the urine and thus maintain or heighten its acidity. Salicylic acid ($C_6H_4 \cdot COOH \cdot OH$) is dealt with in the body in the same way that benzoic acid is, the greater part of it becoming conjugated with glycocoll to form salicyluric acid which, like hippuric acid, is an almost inert and non-poisonous substance (Stockman). A varying amount—usually quite small—is excreted as sodium salicylate, but in such dilution that it cannot be at all effective against the bacteria of putrefaction, and in any case sodium salicylate is a feeble antiseptic. Salicylic acid on the other hand is powerfully antiseptic, but is never found free in the urine. If added to urine it can be readily washed out again with chloroform; but in persons taking up to 180 grains of sodium salicylate per day and with urines of high acidity no free salicylic acid, or only a doubtful trace, was ever obtained, and even when it was given with large doses of acid sodium phosphate the result was always the same.

As sodium salicylate is excreted as an alkaline salicylurate or partially unchanged it does not directly increase the titrable

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acidity of the urine (with NaOH). Very many observations of this kind were made on persons taking ordinary doses, but there was never any *abnormal* increase in the total acidity. After the conjugation of salicylic acid with glycocholic the salicyluric acid so formed requires alkali, which it withdraws from the blood, and this tends to render the urine more acid. As is well known very large doses of salicylic compounds may thus produce acidæmia with grave or even fatal results, and with the typical symptoms of acidosis.

B. coli and staphylococci grew quite well when inoculated into tubes containing urine from patients who were receiving large doses of sodium salicylate, and there is no reason to think that such urine has much, if any, restraining influence on their growth. Some strains of streptococci also grew quite well, while others seemed to be considerably inhibited.

SALOL appears in the urine as sodium salicylurate and sodium sulphocarbolate, both of which are substances of negligible antiseptic power, in addition to which they can be present with ordinary dosage only in very small quantity and in very diluted form. It is difficult to understand how salol ever came to have any great clinical reputation as a urinary antiseptic.

No therapeutic investigations have ever been made with AMMONIUM SALICYLATE for the purpose of comparing its action with that of ammonium benzoate on putrefying urines, nor is it known whether in such urines salicylic acid is regenerated from salicyluric acid as benzoic acid is from hippuric. Further, salicylic compounds are much more toxic than benzoic, and hence in urinary cases it is preferable to use the latter as is the custom in practice.

Boric Acid.

Boric acid is a very weak acid and a feeble antiseptic, but clinically it is extremely useful and of great practical value in the treatment of certain urinary infections. It is eliminated by the kidneys probably as the metaborate (NaBO_2) or pyroborate ($\text{Na}_2\text{B}_4\text{O}_7$) of sodium or other alkali. Its action is exerted irrespective of whether the urine is acid or alkaline, and this is often a great advantage and of especial utility in cases in which it is found impossible or undesirable to maintain an acid reaction.

Clinical Uses.—In the acute *B. coli* pyelitis of children and adults, and in acute cystitis, it may be given along with the

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usual alkaline treatment from the very beginning, and adds a valuable antiseptic element to the merely symptomatic effects of the alkalis. In staphylococcic and chronic *B. coli* infections and in ammoniacal cystitis it often acts as well as reputedly more powerful remedies, and it can if necessary be combined with these. At the same time it may be used as a lotion to wash out the bladder.

In treating acute cases of pyelitis and cystitis with alkalis it is often difficult to maintain a steady alkaline reaction of the urine, and in adults 150 grains (10 grams), or a good deal more, of sodium or potassium citrate in twenty-four hours may be requisite. Sodium bicarbonate, which is a more rapid and effective alkaliniser of the urine, may be given separately and in addition, to an amount which serves to keep the urine alkaline to litmus paper. The advantage of using the two alkaline salts simultaneously lies in the risk of disturbing gastric digestion by the continued administration of large doses of the bicarbonate, whereas potassium citrate is a neutral salt only converted into the carbonate after it reaches the blood. Even when extreme doses of alkali are given the pH of the urine does not go much beyond 8 on the alkaline side, and after some days always tends to decrease, as if some adjustment were being effected by the body against the large intake of alkali.

The ordinary dosage of boric acid is 10 to 15 grains three or four times daily. Ten grains hardly dissolves in half an ounce of water, but almost does so with the help of a drachm of glycerin. Sodium or potassium citrate also increases its solubility so that boric acid 10 grains, potassium citrate 20 grains, and water to $\frac{1}{2}$ oz. make a perfectly clear solution, and if a larger dose of boric acid is desired it can be dissolved up by including enough glycerin in the prescription. Similar mixtures with potassium acetate give a precipitate. Boric acid 10 grains, ammonium benzoate 20 grains, and water to $\frac{1}{2}$ oz. also form a perfectly clear solution, and the combination is a very useful one when the urine is alkaline and infected. Hexamine (10 grains) can be added to it, and although the solution is an acid one and sets free a certain amount of formaldehyde, the amount is so small that it is negligible as regards any stomach disturbance. If the urine is alkaline it is useless to add the hexamine, but given an acid urine the combination of these three substances is the most powerful urinary antiseptic I know.

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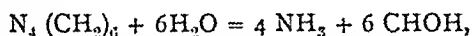
The Action of Urinary Antiseptics

The urine of persons taking 10 to 15 grain doses of boric acid thrice daily shows no change in its titrable acidity beyond the normal variations, and also no increase in its pH value as it is a very weak acid and dissociates very feebly in solutions. The action must therefore depend on the somewhat weak antiseptic effects of the borates present, and is merely inhibitory to the growth and vitality of the bacteria. As a set-off to this the borates probably do not lessen the defensive and recuperative powers of the leucocytes and tissues generally, which may thus be left in a better position to deal with the invading organisms.

Boric acid in repeated small doses used as a food preservative has acquired the reputation of being highly injurious. It is said to cause irritation of the intestine, skin eruptions and falling out of hair, nephritis, and malnutrition. In giving it, often for weeks at a time, to patients with *B. coli* infection of the bladder, I have never met with any of these injurious effects.

Hexamine.

The mode of action of hexamine and its clinical value and limitations are now so well understood and appreciated that a mere re-statement of the chief points is all that is necessary here. It is a white crystalline substance very soluble in water and is made by the interaction of ammonia and formic aldehyde. In acid solutions it at once begins to decompose again,



and its action as a urinary antiseptic depends on this liberation of free formaldehyde. In alkaline solutions no decomposition takes place. Hexamine is non-toxic, it is rapidly absorbed, circulates in the blood unchanged, begins to be excreted in the urine in about twenty minutes, and reaches its maximum amount there in about four hours or more. It is only when it comes into contact with acid urine in the kidneys and bladder that any formaldehyde is set free, and in a weakly acid solution such as the urine this usually occurs slowly and to a comparatively limited extent. With a dosage of 40 grains daily it is present in the twenty-four hours' urine (say) as about 1 in 500 parts; but the amount of formaldehyde split off in the bladder has never been estimated higher than 1 in 5000 parts of urine, and ordinarily is certainly very much less than this.

The amount varies greatly with different urines, most probably according to their hydrogen ion concentration, and this constitutes an element of uncertainty in treatment. With full doses hexamine is always abundantly excreted in the urine, the trouble being that it does not split off formaldehyde in sufficient amount, and if the urine is already definitely acid the administration of acid sodium phosphate in ordinary doses does not materially, if at all, increase the true acidity and therefore does not lead to a greater production of formaldehyde. When there is pus, epithelial cells, and mucus, these combine with and fix the formaldehyde and thus lessen the amount in solution.

Clinical Uses.—A strength of 1 in 5000 is not strong enough to be bactericidal (except perhaps in the case of *B. typhosus*), but very much weaker dilutions are very inhibitory to the growth and vitality of *B. coli*, staphylococci, and streptococci, while the gonococcus and tubercle bacillus seem to be quite unaffected. It is useless to give it as long as the reaction of the urine is alkaline to litmus, and unless the urine can be previously made acid with acid sodium phosphate, ammonium benzoate, boric acid, or a combination of these. An effective dose is 10 to 15 grains three or four times daily, and added to this there must be a frankly acid reaction of the urine as formaldehyde is liberated by all urines which show a hydrogen ion concentration well on the acid side of pH_7 , which is tantamount to a distinctly acid litmus reaction. It is always well to make sure that free formaldehyde is present, and the most convenient test for this is to add to the urine in a test tube a few drops of a 1 per cent. solution of phloroglucin followed by a few drops of a 30 per cent. solution of sodium hydrate, when a deep cherry-red colour develops.

Some cases of coliform and staphylococcic infection clear up very satisfactorily with hexamine; but persistent treatment for months is often necessary to wear down the vitality of the bacteria, so that the natural defensive powers of the tissues can ultimately deal with and exterminate them. The bladder symptoms subside very rapidly in most cases and this is apt to lead to a want of persistency in treatment.

Hexamine decomposes so gradually that as a rule very little formaldehyde is set free in the kidney, and hence it is of only moderate value in treating pyelitis.

When it is prescribed in mixture with acid sodium phosphate formaldehyde is set free, but never in sufficient amount to

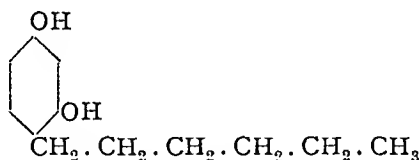
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disturb the stomach if the mixture is to be finished in a few days. It is customary, however, to dispense them in separate bottles.

Cases have been recorded in which it has caused renal irritation and bleeding, and more frequently strangury, pain, and irritation in the bladder. The former must be very rare and so is strangury, for after much experience in giving hexamine I have never seen either occur, although some irritation of the bladder is not so uncommon. Such symptoms subside rapidly if the urine is made alkaline with sodium bicarbonate. I have tried washing out the bladder with solutions of formaldehyde 1 in 3000 to 1 in 5000, but they always caused a great deal of local irritation and had to be given up.

Hexyl-resorcinol.

In the course of a research designed to discover an ideal internal antiseptic Johnson prepared this substance, and on examination it was found to be non-toxic to man in therapeutical doses and to render the voided urine highly bactericidal *in vitro*. It is the hexyl alkyl derivative of resorcin ($C_6H_3(OH)_2C_6H_{13}$)



and is a white wax-like solid insoluble in water but soluble in olive oil. It is stated to be 46 times more potent than phenol as a germicide and 150 times more than resorcin, and "is believed to be one of the most powerful organic germicides ever described." Unfortunately it is detoxicated in the body by being conjugated previous to its excretion in the urine and the conjugated compound is inert. A small portion of it seems usually to escape detoxication, and it is this portion, irregular in amount both in the same and different individuals and at different times, which is effective against bacteria in the urinary passages. It has the great advantage of being active in urine of either acid or alkaline reaction, but curiously enough if sodium bicarbonate be given at the same time the urine is deprived of bactericidal powers. No satisfactory

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explanation of this is meantime forthcoming, but it has been ascribed to change in the surface-tension of the urine. In 1924 Leonard published two papers describing its action on man and animals and detailing its effects in cases of urinary infection with *B. coli* and various cocci. From these it appears to be very active against the latter but not so satisfactory against the former. Judging from only a moderate amount of experience of it in *B. coli* infections and in mild cases of staphylococcic infection with alkaline urine, I cannot say the results have been better than those obtained with other urinary antiseptics. It reduces the number of organisms and relieves symptoms promptly enough, but is not specially effective in eradicating the infection. I have not had a good opportunity of testing its efficacy in a severe case of ammoniacal cystitis.

It is given in gelatin capsules containing 0.15 gram dissolved in olive oil, two to four capsules thrice daily after food, or in a 2½ per cent. solution in olive oil of which a teaspoonful constitutes a dose (equal to 0.1 gram). It is irritating to the stomach and is therefore best given after food, and the larger doses are apt to cause catharsis which usually, however, ceases after a day or two. Its relative clinical value can only be determined after a much longer and more general trial than it has as yet had. Although it emanates from research work in a medical school, it is the subject of a patent both in the United States and in this country.

Methylene Blue—Acriflavine.

I have used METHYLENE BLUE occasionally for many years past in treating cases of *B. coli* cystitis in doses of 2 grains (in pill) three or four times daily. It colours the urine blue which is an objection to its use. Its action is quite definite and comparable to that of hexamine. The organisms and the pus and the subjective symptoms usually diminish very markedly in a few days, but the infection persists.

ACRIFLAVINE is stated by Browning and Gulbrandsen to have the very unusual property of being more active as a bactericide in serum solutions than in water. It is excreted in the urine to which it imparts a deep yellow colour and marked bactericidal properties *in vitro*, and they suggest that it may prove of value in combating infections of the kidney

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and urinary passages. It was given in a dose of $1\frac{1}{2}$ grains (0.1 gram) thrice daily in keratin capsules, and the necessity of administering it in this way proved to be a serious practical drawback. If the capsules were not sufficiently coated they burst in the stomach and caused severe and sometimes prolonged sickness, and if too thickly coated they were apt to pass through the intestine unchanged. With care, however, these drawbacks can be avoided and the urine kept of a deep yellow colour. The urine did not prove to have any marked bactericidal properties in cases of *B. coli* and mild septic infections, and there took place merely a certain amount of inhibition of the bacterial growth. Acriflavine is much more active as a bactericide in alkaline than in acid media outside the body, but in several cases of *B. coli* cystitis I have kept the urine alkaline for weeks at a time while acriflavine was being given, without perceptibly increasing its therapeutical effects.

Copaiba—Oil of Sandal Wood.

Observations were made clinically with the Resin of Copaiba and with the essential Oil of Copaiba. Both were prepared specially pure.

The RESIN was given as an emulsion in 30 gr. doses thrice daily (6 grams). It did not impart to the urine the well-known copaiba odour, nor did it appear to produce any local or systemic effects. The urine exposed to the air putrefied in the same varying times as normal urines, and *B. coli*, staphylococci, and streptococci when inoculated into test-tubes containing it grew very well. It is excreted abundantly in the urine, which with strong H_2SO_4 gives a deep red colour, and with HNO_3 a precipitate resembling albumen but soluble in alcohol. In a case of gonorrhœa it had no apparent action in checking the discharge.

OIL OF COPAIBA was given in 15 minim doses three, four, and six times daily. The urine always had a characteristic odour, and gave a deep red colour with H_2SO_4 but no precipitate with HNO_3 . It is said to be excreted in the urine partly in combination with glycuronic acid and partly unchanged. The voided urine became ammoniacal within normal limits of time, and in test-tube experiments with *B. coli*, streptococci, and staphylococci there seemed to be no hindrance to their growth. Test-tube experiments of

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this kind cannot, however, be taken as an exact criterion of what happens in the body, because many cases of *B. coli* cystitis when treated with oil of copaiba and with oil of sandal-wood showed at once marked improvement in symptoms and a diminution in the number of organisms. The organisms never entirely disappeared, however. In gonorrhœa and gonorrhœal cystitis the action of large doses (60 to 90 minims per day) was very marked. With our present knowledge we can only conclude that the action of these essential oils is a selective one on the gonococcus, and one which is not shared by any of the other ordinarily used urinary antiseptics.

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ÆTIOLOGY OF PELLAGRA.

By WILLIAM SUSMAN, B.A., M.D., (Q.U., Can.)

(From the Pathological Laboratory, The Royal Hospital,
Morningside, Edinburgh.)

IN studying the morbid anatomy and histology of pellagra, the distribution of the lesions amongst the organs, and the tissue changes within the structures suggested a blood borne infection as highly probable.⁵

This view is supported by the fact that a mononuclear cell increase is a feature of the blood picture in pellagra. Many authorities have suggested an infectious causation. Amongst these are McNeal,¹ Siler, Garrison and McNeal,² and Wood.³ Further support is gained by the work of Palmer and Secor,⁴ who treated a series of cases with autoserum and obtained favourable results. Harris⁶ claims to have produced the disease in a monkey by the inoculation of a filtrate from a pellagrous lesion.

The possibility of a protozoan organism being present, as suggested by E. J. Wood,³ was first considered. 10 c.c. of defibrinated blood from a well-marked pellagrin, to which 1.0 c.c. of a 50 per cent. solution of glucose had been added, was incubated anærobically at 37° C. After twenty-four hours' incubation, hanging drops were examined and highly motile organisms dashed across the field especially when the material was taken from the bottom layer of the culture.

Previous experiments suggested that for this organism a glucose egg agar was the preferable medium. With this basis my assistant, Miss Pairman, made a suitable combination by the use of equal parts of + 6 glucose agar and egg broth* prepared for both stab and slope cultures. Egg broth was also used separately.

Stab and slope culture tubes of glucose egg agar as well as egg broth, abundantly controlled, were inoculated with

* + 6 Glucose Agar—

| | | | |
|-----------------------|-----------|-------------|-----------|
| Glucose . . . | 10 grams. | Lemco . . . | 10 grams. |
| Sodium Chloride . . . | 5 " | Agar . . . | 30 " |
| Albumin peptone . . . | 10 " | Water . . . | 1000 c.c. |

 Titrated with N. sodium hydroxide.

Egg Broth—

| | | | |
|---------------|---|-----------------|----------|
| Egg | 1 | Water | 300 c.c. |
|---------------|---|-----------------|----------|

William Susman

material from the serum, from the upper layers of blood cells and from the lowest layer, of the original blood culture.

After ten days to three weeks a growth appeared in the stab culture and to a minor degree on the sloped media, all of which had been prepared as anaerobic media. The growth was quite abundant in about six weeks. The colonies were of an opaque white appearance, about 1 mm. to 2 mm. in diameter and tended to form masses. The spread was downwards and outwards in fan shape, a further indication of motility. In several tubes, the tendency was for the spread to continue by preference between the medium and the tube. Inoculations from the bottom layer of the blood culture gave the best results.

Although original attempts at culturing the organism on blood agar failed, subcultures from glucose egg agar produced a marked growth within a week on a sloped medium. The surface was well covered with discrete, colourless pin-point colonies.

Microscopical Characteristics.—The organism was an anaerobic bacillus of about $\frac{0.5 \text{ to } 2}{1000}$ in length and about $\frac{0.2 \text{ to } 0.5 \text{ mm.}}{1000}$ in width. It stained readily with aniline dyes, giving a coccal or diplococcal appearance, but in the Loeffler's methylene blue preparations a bacillary form was evident, with deeply staining polar structures, which occasionally caused bulging. In many bacilli one or more of these deeply staining bodies were seen in the more central portions. With Neisser's methylene blue and bismarck brown stain the results were definitely negative. Dilute carbolfuchsin stained the bacillus readily giving it a solid appearance with rounded ends and showed it to have a strong tendency to group in palisade formation.

The bacillus is gram fast but to no degree acid fast.

The organism was propagated through four subcultures over about three months. Similar results were obtained from two out of the three attempts from the blood of the same patient. Agglutination reactions with dilutions up to 1 in 640 gave positive results on two different occasions.

Before concluding, it must be added that in another case when the skin eruption had recently developed for the first time, and in whom the eruption still existed, the bacillus

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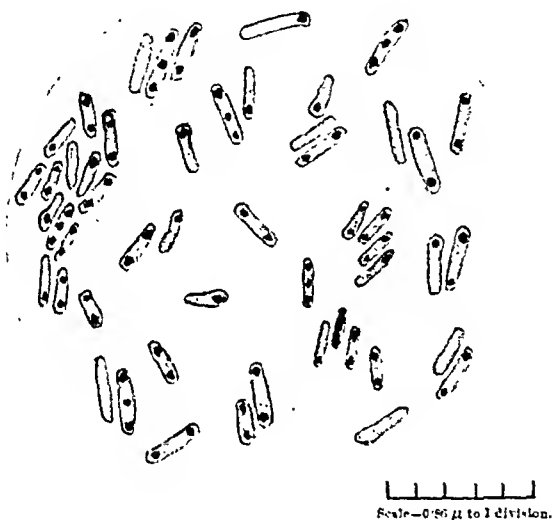
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Ætiology of Pellagra

described above was readily found, in blood culture, in subcultures in egg broth, and on glucose egg agar.

I am greatly indebted to Professor Robertson for his advice and assistance throughout this investigation; to Doctors Davie and Alexander for their readiness in supplying material, and to Miss Pairman for the enthusiastic manner in which she carried out everything that was left in her charge.



Loeffler's methylene blue.

Appendix.—Since this article was written, I have isolated the organisms in two further cases, making four in all.

A modified technique proved to be as efficient in producing a growth, and at the same time the growth was visible in a shorter time and the process more convenient.

About 5 cc. of blood from the pellagrin is pipetted into a tube of broth or glucose broth, the surface of the broth having previously been covered to the depth of 1 inch with sterile liquid paraffin. The culture is incubated at 37° C. This original culture is subcultured about every week until the culture is no longer pigmented with hæmoglobin. At that time there usually is an appreciable deposit of growth at the bottom of the culture tube.

William Susman

The organisms have no definite sugar reactions. In the later stages of this investigation, it proved to be variable with Gram's stain.

I am indebted to Dr Watson of Rainhill for his helpful interest and for generously supplying me with blood from pellagrins.

For technical assistance and suggestions I am grateful to John Stanbrook my late laboratory assistant. The enthusiasm with which he assisted in every branch of this investigation was equally as helpful.

REFERENCES.—¹ Thomson-McFadden Pellagra Commission, U.S.A. ² Siler, Garrison, and MacNeal, *Journ. Amer. Med. Assoc.*, 1913, vol. lxi., p. 1713; 1914, vol. lxiii., p. 1093. ³ E. J. Wood, A Treatise on Pellagra, 1912, based on Report of Pellagra Commission, N. Carolina Board of Health, U.S.A. ⁴ Palmer and Secor, *Journ. Amer. Med. Assoc.*, 1915, vol. lxiv., p. 1566. ⁵ Susman, W., *Edin. Med. Journ.* Feb. 1926. ⁶ Harris, W. A., *Journ. Amer. Med. Assoc.*, 21st June 1913, p. 1948.

CLINICAL RECORDS

MYDRIASIS AND CYCLOPLEGIA AS A RESULT OF HERPES OPHTHALMICUS.

By LAURA M. LIGERTWOOD, M.B., Ch.B., F.R.C.S., Clinical Tutor,
Eye Department, Royal Infirmary, Edinburgh; Assistant Ophthalmic
Surgeon, Leith Hospital, etc.

THE following is the report of a case which seems to be of more than purely ophthalmological interest.

Miss M. W., clerkess, aged 29, was first seen by me on 8th December 1926, when she complained of dimness of vision and inability to read with the right eye.

History.—In June 1921, the patient had an operation for glands in the neck (on inspection there is a long scar running down the anterior border of the right sterno-mastoid). Two weeks after the operation she noticed that the right upper lid was drooping and that the right pupil was very small. This appearance was confirmed by a photograph. The ptosis wore away gradually, and the pupil increased in size although it never became as large as the left.

In July 1925, she had complained of severe pain in the region of the right eye and right side of forehead, which lasted three days and was followed by a herpetic eruption. She says that at that time there was a blister on the cornea; on examination there is facetting to be seen. Two or three weeks after the commencement of the herpetic attack she noticed that the right pupil was dilated and vision indistinct, with great difficulty in reading. She also complained of numbness of the right side of the forehead. She had never worn glasses or had any previous eye trouble.

First Examination, 8th December 1926—Right eye.—Pupil dilated, direct reflex and reflex on convergence were absent, consensual reflex light on R, contraction L; light on L, no contraction of R. Cornea showed facetting, and both the shadow by retinoscopy and reflection of ophthalmometer mires were irregular, fundus normal—no ptosis. RV = 6/36 no improvement with glasses. *Left eye* normal LV = 6/6. J1.

Second Examination, 9th December 1926.—With $\frac{+0.75}{+1}$ 165 degrees. in front of R eye and +3 in front of L eye (thus blotting out vision of L eye), with some persuasion, vision of R eye was found to be 6/9, and when +3.5 was added to the distance correction reading vision of R eye was J1.

On testing both eyes together, reading was found to be unocular.

Laura M. Ligertwood

Third Examination, 22nd January 1927.—Condition unchanged. On this occasion eserine was instilled into the right eye and was followed by contraction of pupil and stimulation of ciliary muscle to such an extent that J₁ was read quite easily with only the distance correction worn.

Fourth Examination, 26th February 1927.—1 per cent. atropine was instilled and had no effect; 4 per cent. cocaine was instilled and had no effect.

There seems little doubt that here we are dealing with two independent lesions: first a lesion of the sympathetic which has paralysed the dilator pupillæ; and secondly, a lesion of the oculo-motor which has paralysed the sphincter.

The first lesion presumably occurred during the operation for incision of glands in the neck when the sympathetic must have been injured.

Regarding the second there is good evidence to believe that ophthalmic herpes is dependent on definite lesions in the Gasserian ganglion which is morphologically a dorsal root ganglion. This lesion would affect branches of the trigeminal nerve and is shown by the characteristic situation of the vesicles. It is stated by some authors that the eye is never involved unless the naso-ciliary branch is affected, but this does not seem to be always the case. That the oculo-motor nerve may also be involved causing mydriasis and paralysis of accommodation is stated by Fuchs, and such seems to be the condition in this case.

My thanks are due to Dr John Darling for his kind permission to publish this case, and to Professor Bramwell for the use of his report.

A Case of Sarcoma of the Uterus

REPORT OF A CASE OF SARCOMA OF THE URACHUS.

By DAVID M. GREIG, C.M., F.R.C.S.E., F.R.S.E., Conservator, Royal
College of Surgeons' Museum, Edinburgh.

SEVEN years ago an unmarried nulliparous woman aged 30, of fine physique and unexceptionable personal history, was referred to me on account of a suprapubic tumour. The swelling had been noticed accidentally about eight months previously and had latterly increased considerably in size. It was smooth, oval, and painless and projected apparently from the pelvis half way to the umbilicus. It was not freely movable but could be pushed a little from side to side. No fluctuation could be made out. Since noticing it an occasional ache in the groins and down the thighs had suggested to her that her work as an instructress in physical culture might not be continued with impunity. She had not lost colour, weight, or strength and there had been no menstrual irregularity, but her medical attendant thought that recent alterations in her likes and dislikes and in her habits and her temperament might indicate a uterine or ovarian affection.

Accepting this as a probable diagnosis, a few days later through a median infra-umbilical incision the abdomen was opened cephalad to the superior pole of the tumour, which was found to be extraperitoneal. The opportunity showed the pelvic organs to be normal and the peritoneal incision was then closed.

The tumour was situated in the extraperitoneal areolar tissue deep to the fascia transversalis. It was solid and soft and encapsuled by a thin membrane. It had no attachment to the umbilicus and was easily enucleated, and at its inferior extremity the delicate capsule concentrated to a fibrous strand which passed to the urinary bladder and was divided between ligatures well away from the tumour.

Convalescence was uneventful and there has been no recurrence nor any deterioration in health during the subsequent seven years.

The tumour on section was of a uniform greyish-yellow colour, homogeneous in consistency except here and there where degeneration had formed small irregular cavities. The capsule was delicate and thin and did not apparently supply septa to the tumour which microscopic examination showed to be a small spindle-cell sarcoma.

In a paper on solid tumours of the urachus Brady states that,

David M. Greig

including his case of fibromyoma of the urachus in a xi-para, æt. 43, only twenty cases of solid tumour of the urachus have been recorded. He gives a synopsis of the nineteen previously published cases. A case of carcinoma of the urachus in a man æt. 39 recorded by Randall seems to have escaped his notice. No generalisation can be made from only twenty-two cases spread over such a long period (to 1868), some occurring in pre-antiseptic days when abdominal tumours were but rarely operated on. There is occasionally a history of patent urachus in infancy, but in my case there was no knowledge of any congenital defect nor was there any abnormal appearance about the umbilicus. In three of the cases referred to in literature the sex and age of the patient are not recorded. Of the remaining cases fifteen were males and (including my case) four were females. The ages varied from 11 to 82, an average of 43 years. In only two instances were the tumours benign and both were fibromyomata. Of the twenty malignant tumours twelve were carcinomata and eight were sarcomata. In five cases the carcinoma had occurred in a urachal cyst, and in one case the malignant tumour seemed to have followed a vesical schistosomiasis. A fatal issue is recorded in eight cases. The malignant growth may spread to the bladder along the distal portion of the mesial abdominal ligament, the obliterated part of the urachus. Probably it is specially liable to such extension if obliteration of the canal between the tumour and the bladder has not taken place. The neoplasm may involve its capsule and spread into the muscles or on to the peritoneum. Such extensions necessitate serious and extensive operations if extirpation be attempted.

The post-operative observation of these individuals who are reported as having recovered is lamentably short; indeed it appears in no instance to have exceeded one year. In this respect my case seems unique. Perhaps the early stage at which it was dealt with, perhaps its complete enclosure in a definite capsule not adherent to surrounding structures, and perhaps the complete closure of the urachus between the tumour and the urinary bladder may have determined its complete removal and may justify the hope that a seven years' freedom from recurrence or metastases may mean life-long immunity.

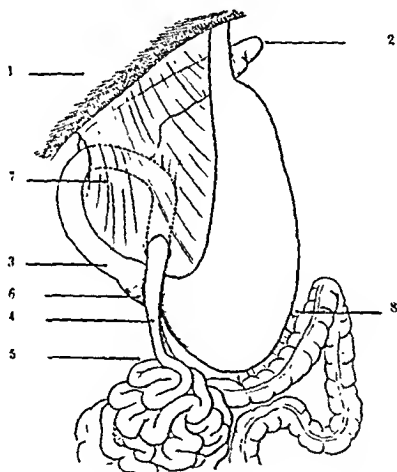
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PERISCOPE

PYLORIC OBSTRUCTION FROM CONGENITAL MESENTERIC DYSPLASIA.

A female aged 61 was admitted with acute intestinal obstruction of eight days' duration. The obstruction was absolute and had been accompanied by vomiting. Her features were drawn, the pulse thready and uncountable and her respirations were 48 per minute. The abdomen was absolutely flat and there was some supra-umbilical tenderness.

A median supra-umbilical cœleotomy showed the stomach distended, stretched almost to its upper segment and situated entirely to the left of the middle line. The pyloric antrum was compressed by a loop of small intestine which crossed the small omentum towards its



1. Liver ; 2. Pancreas ; 3. Pylorus ; 4. Duodenum ; 5. Small intestine ; 6. Prepyloric depression ; 7. Fibrous sheet ; 8. Adhesions between colon and stomach.

lower part just over the smaller curvature. On raising the loop the pyloric antrum was found deeply notched, the impression being of old standing and apparently due to the weight of the loops of small intestine crushing the pylorus against the anterior surface of the vertebral column. A gastrojejunostomy was performed but the patient died 14 hours later. Distal to the pylorus this small intestine was gathered into a sort of ball and possessed no mesentery. The arrangement is shown in the diagram.

Note.—Here is the congenital condition which results from imperfect rotation of the midgut during development and which predisposes to volvulus neonatorum the successful treatment of which has recently been reported by Dott (*B. M. J.* 1927, I. 230) in a child 8 days old. The existence of the congenital abnormality in a female aged 61 shows that volvulus might result at any age and is not a prerogative of infancy. Férey's case also shows that volvulus is not the only danger, but that the mechanical weight of the mesentery less small intestine may be a factor in duodenal or pyloric obstruction.

D. FÉREY, "Occlusion stomacale aiguë par disposition congénitale anormale" (*Ann. d'anat. pathol. et d'anat. normal. médico-chirurg.*, Paris, 1926, iii., 996).

TRAUMATIC MEDIASTINAL EMPHYSEMA.

A motor cyclist in collision with a carriage was struck on the right chest by the shaft and sustained a double fracture of his 2nd, 3rd and 4th right ribs. The coverings of the injured part moved with respiration and there was evidence of a right pneumothorax with slight left displacement of the heart. There was considerable shock, no hæmoptysis; and subcutaneous emphysema which spread towards the abdomen was noticed. Within the succeeding few hours the increase of emphysema progressively embarrassed the breathing and the heart's action, and 5½ hours after the accident asphyxia seemed imminent and consciousness was lost. Under local anæsthesia an incision was made over the jugular notch, the anterior jugular veins avoided, and with a finger the mediastinal cellular tissue was entered. Gas under pressure at once escaped. The cellular tissue on each side of the trachea was further torn to allow of the introduction of two drainage tubes. The right pleura was incised in the 9th intercostal space but there was no pneumothorax within the serous membrane. Improvement was immediate and convalescence unprotracted.

Such emphysema is the result of rupture of a bronchus at the pulmonary hilum. It is a common occurrence in experimental pulmonary resections. In Baranger's case the emphysema was both mediastinal and parietal, and as usual the chief danger was from pressure on the venous trunks. Prompt treatment is demanded and the indication is suprasternal incision to reach and drain the mediastinal cellular tissue.

BARANGER, "Un cas d'emphysème médiastinal traumatique" (*Bull. et Mém. de la Soc. Nat. de Chirurg.*, Paris, 1926, lii., 1243).

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BILATERAL RUPTURE OF BICEPS.

Simultaneous bilateral rupture of the long head of the biceps brachii is an uncommon event, and the simplicity and efficacy of the operative treatment adopted by Baumgartner in a case which he reports are worthy of notice. The accident occurred in a strong, healthy blacksmith aged 53, who was supporting at the level of his face a heavy plank, his forearms in flexion and full pronation with the palms upwards. His fellow workman suddenly loosed the other end of the plank and the blacksmith immediately, in an instinctive effort to save his end from falling, slid his hands under the plank, turning the forearms from full pronation into extreme supination the right-angle-flexion being continued. Simultaneously and symmetrically the long tendon of each biceps ruptured. A month afterwards the nature of the injury was obvious and on flexing the forearm a muscular swelling bulged in front of the centre of each arm. The muscles were operated on at a fortnight's interval. In each the aponeurosis was found intact, and the proximal portion of the tendon was short and high up in the intertubercular sulcus. Its position and shortness would have made end-to-end suture difficult, so the operator contented himself by suturing it to the periosteum of the humerus at the distal end of the sulcus with an entirely satisfactory result both cosmetically and functionally.

BAUMGARTNER, "Rupture bilatérale du tendon de la longue portion du biceps brachial" (*Bull et Mém. de la Soc. Nat. de Chirurg.*, Paris, 1926, lii., 1225).

"GANGLIA."

The comparative insignificance of the synovial cysts less commonly found elsewhere than about the wrist has, according to Lecène, favoured a wider acceptance of their being hernial protrusions of the joint synovial membrane than is perhaps warrantable. Surgeons made out what they expected to find, blamed maladroitness or imperfect technique for recurrences and despised histological examinations of such unimportant structures.

Lecène considers such tumours to be pseudocysts from a degenerative lesion of the areolar connective tissue or of the tendon itself, characterised by an "apple jelly" gelatinous liquefaction of the collagenic substance along with cell changes which are not inflammatory.

He cites three cases, two in relation to the ligamentum patellæ occurring in individuals 33 and 28 years of age. The tumour, with in one case the bursa deep to the ligamentum patellæ, was excised intact and after due preparation thoroughly examined. No connection existed between the pseudocyst and the joint or the bursa. The

Periscope

degeneration affected a localised portion of the peri-articular tissue between these structures. Bundles and individual fibres of connective tissue were separated by liquefaction of their interstitial substance. The cells stained badly, were ill-formed, and no test indicated the presence of mucus.

Lecène's third case was that of a woman aged 33 in whom 40 mm. of the extensor tendon of the left middle finger formed a tumour at the wrist. The entire affected portion was removed. The cavity was within the tendon, and showed on microscopic examination the same liquefaction of the interstitial substance between the tendon fibres which were widely separated thereby. The connective tissue cells had undergone alterations in shape, size and reactive properties, obviously degenerative and not inflammatory, and the wall of the pseudocyst was composed of thinned-out tendon.

Note.—The experience of many will approve Lecène's scepticism as regards hernial protrusions from bursæ and tendon-sheaths, but his deductions as regards the joints seem to require independent investigation.

P. LECÈNE, "Trois cas de dégénérescence gélatineuse pseudokystique du tissu conjonctif juxta-articulaire et du tissu tendineux" (*Bull. et Mém. de la Soc. Nat. de chirurg.*, Paris, 1927, liii., 2).

MIXED TUMOURS OF THE SALIVARY GLANDS.

With special objects in view, McFarland adds to the already fairly extensive literature of these tumours a review of 90 cases and he comes to the conclusion: 1. That accidental sequestration of embryonal cells is the most satisfactory explanation of their origin. 2. That mixed tumours are individual entities and do not arise from the structures in which they occur. 3. That they ought to be called "mixed tumours" and nothing else irrespective of their histology. 4. That they are inherently benign but commonly recur after (imperfect?) excision, and if frequently disturbed become locally destructive and invasive without metastasizing. 5. That their histology is no guide to prognosis. 6. That rapid enlargement of a mixed tumour of long duration and slow growth is *not* the result of malignant change. 7. That malignant change, whether sarcomatous or carcinomatous in mixed tumours must be rare and that its occurrence is difficult to prove. Adding to his own collection 290 cases from literature he finds that no period of life is exempt from such tumours but they are most commonly observed between the ages of 20-40 years. Of the mixed tumours McFarland studied recurrence took place in 25 per cent. A single excision followed by no recurrence took place in 47 cases, of whom 8 had died later of some intercurrent disease, and 39 were well at

Periscope

from one year to sixteen years after operation. Recurrence took place in 19 cases, and in some a second, third and fourth operation was performed, and of these individuals 3 had died but not of the tumour. Even when the histological appearances were suggestive of sarcoma, as they were in 5 cases, the operation was invariably successful; one individual died of myocarditis two years after the operation, while the others were well at periods varying from four years to nine years after operation. In 4 cases the histological appearances were suggestive of carcinoma, one individual died of cirrhosis of the liver sixteen years after operation, one of pulmonary tuberculosis nine years after operation, and the other 2 were well without recurrence fifteen and one and a half years respectively after operation.

In a series of 14 cases most of the parotid, but some of the mandibular salivary glands, and some perhaps branchiogenic in the neck, the condition appeared to have been carcinomatous from the start. Of these, 11 died of early recurrence, one was well two years after operation, and 2 were still under X-ray treatment.

The paper is an interesting and convincing one and of great clinical value, but as McFarland points out recurrence may be long delayed and statistics cannot say "no recurrence" until each individual life is closed.

J. MCFARLAND, "Mixed tumours of salivary glands and neck"
(*Am. Journ. Med. Sc.*, Philadelphia, 1926, clxxii., 804).

TETANY AND PARATHYREOIDITIS.

The subject of whom observation was made while in Professor Bard's wards was a mason 47 years of age. He was of good family history. During the War he had been gassed on two occasions, had been a prisoner of war during thirty-three months, and was presumably bronchitic. He admitted bibulous habits but denied syphilis. Married at 25, his first child died aged 15 days, but his wife and a younger daughter are well.

Cough and loss of flesh commenced five years ago, and latterly he had superadded anorexia, considerable weakness and pains in the lower limbs of a constrictive character. Diarrhoea with occasional vomiting preceded his admission to hospital. He had copious expectoration devoid of tubercle bacilli. His pulse had no increase of tension. No tendon reflexes were elicited, but there was no disturbance of sensation and no ocular symptoms. There was slight albuminuria. The Bordet-Wassermann reaction of the cerebro-spinal fluid was negative. (The blood reaction does not seem to have been taken.)

A fortnight later he complained of cramp in both hands during the night, and stated that he had had similar phenomena during eighteen days before admission. Radiography showed a small stomach without

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evidence of tumour. In the evening he had an attack of generalised tetany. The stomach still contained some barium when screened and appeared oblique and fixed under the liver, which with diminution in size seemed to justify a diagnosis of chronic gastritis. There was a leucocytosis of 42,000, erythrocytes numbered 4,061,000 and there was 80 per cent. hæmoglobin. The blood calcium was diminished and the absence of free HCl in the gastric contents now suggested a gastric neoplasm.

A series of intravenous injections of CaCl_2 abolished the tetany temporarily, and when it recurred it was accompanied by increase of the bronchorrhœa. The calcium was continued by the mouth, and it was noted that the gastric alkalinity was less pronounced and the hypocalcæmia was slightly diminished. With a cessation of his diarrhœa and an amelioration of his symptoms he returned home, but was readmitted much worse three months later, and death followed a severe attack of tetany a fortnight afterwards.

Post-mortem examination disclosed gummata in the lungs, a slightly hard liver, normal kidneys, and an absolutely normal stomach. There was some thyroid hyperplasia, both the stroma and the epithelium being affected, and there were several adenomata, some of which were calcified.

Of the parathyreoids the right inferior alone was submitted to detailed examination. It was found somewhat enlarged and was very dense and hard. There was perivascular sclerosis, no vesicles, and no colloid nor hæmorrhage. Along with the pulmonary gummata there was a true syphilitic cirrhosis of the lung. Examination of the brain showed small perivascular hæmorrhages in the lenticular nucleus and an abnormal increase of lipochrome in certain nerve cells especially about the lenticular nucleus and the locus cæruleus.

The authors note how misleading were the radiographic findings. The great rarity of pulmonary gummata (Bériel only found 7 or 8 authentic cases) alone makes the case worthy of record. But from the authors' deduction that the presence of typical pulmonary gummata is *proof* of the syphilitic origin of the parathyreoid affection there may be some dissent. Naturally the parathyreoid has not escaped examination in cases of general paralysis of the insane, but the histological findings scarcely accord with those of the case reviewed, and in no case was there accompanying tetany. The omission of the blood Wassermann and the examination of only one of the parathyreoids are serious faults, of which the authors are not unaware, in an interesting and suggestive paper.

L. LANGERON, J. DECHAUME, P. DELORE et J. JEANNIN,
"Tétanie et parathyroïdite syphilitique" (*La Presse Méd.*,
Paris, 1927, xxxv., 81).

D. M. G.

NEW BOOKS

Studies in Intracranial Physiology and Surgery. By HARVEY CUSHING, M.D. Pp. xii+146, with 16 illustrations. London: Humphrey Milford. 1926. Price 10s. 6d.

This small volume contains the three Cameron Prize Lectures delivered by Cushing in October 1925.

Lecture I.—*The Third Circulation and its Channels* describes the cerebro-spinal fluid, its origin, pathways of circulation, its mode of absorption and functions. Interwoven with the description are remarks on the historical, pathological, and surgical aspects of the subject. The specialised cell lining the pia-arachnoid—the meningo-cyte—is especially discussed. Its embryogenesis, phagocytic function, relation to the reticulo-endothelial system, and neoplastic formations are enlarged on.

Lecture II.—*The Pituitary Gland as Now Known* deals with the history, physiologic function, pathology, and surgery of the gland. The discussion includes the most recent developments in this field. It is instructive to note with how much circumspection the experienced lecturer treats a subject on which he is the recognised authority.

Lecture III.—*Neuro-Surgery: Old and New*, gives a graphic picture of the primitive state of the surgery of the nervous system some twenty or thirty years ago. Interesting remarks on the development and technique of various intracranial operations follow. Tribute is paid to ophthalmoscope, perimeter, and X-ray stereoscopy, etc., but the neurological examination remains pre-eminent in the lecturer's estimation. The clinical and pathological classification of intracranial tumours—especially those of the glioma group is rather fully entered into. The correlation of carefully followed clinical history with the microscopic picture of the growth is especially valuable and points out the direction of future progress.

The volume is written in the charming and graphic style which characterises the author's works. It is interspersed with apt and interesting historical references.

A Practice of Physiotherapy. By C. M. SAMPSON, M.D. Pp. 620, with 146 illustrations. London: Henry Kimpton. 1926. Price 45s.

This large book on the practice of physiotherapy contains the personal experiences of the author and it is written largely from the personal standpoint. When the reader becomes accustomed to the style of the author, and to the use of such terms as "professional gyp"

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and "foozlewurt," he will find many useful hints which will be of service to him in the practice of physiotherapy. The physics, technique and apparatus are adequately dealt with in Part I. Part II. deals with the clinical applications of the various methods previously described, and the diseases, which can be treated with more or less success by physical methods, are arranged in alphabetical order. The author gives details of the treatment which he has found to be of service in these cases. The volume is well illustrated and there is a good index. It should prove of service to those engaged in the treatment of disease by physical methods, and no doubt its racy style will be attractive to some readers.

Solubles or Insolubles: "Benzo-Bismuth" in the Treatment of Syphilis.

By Dr HENRI DROUIN. Pp. 96, with 10 illustrations. Paris Editions: Paul Martial. Price 6 francs.

In this little book Dr Drouin discusses the relative merits of soluble and insoluble compounds in anti-syphilitic therapy. He is a vigorous protagonist and supports all soluble preparations in general, and a soluble salt of bismuth, namely, "Benzo-Bismuth in particular. "Benzo-Bismuth is the name which he gives to a sodium derivative of trioxy-bismuth-benzoic acid. In practice this compound which is readily soluble in a 10 per cent. solution of glucose containing carbolic acid is given by intramuscular or subcutaneous injection; the average dose being 20 cgrms., and the average frequency of injections twice or three times weekly. A course of injections usually consists of 15 to 20 doses, and thereafter the patient is given a rest of three weeks before commencing a second course. Severe secondary syphilides disappear quickly after from 4 to 10 injections, as is evidenced by the illustrations at the end of the volume. The compound is well tolerated and its use is not attended by the disadvantages which are sometimes associated with intramuscular injections of insoluble salts. The author has an attractive literary style and makes out a good case for the soluble bismuth preparation which he favours.

The Elements of Medical Treatment. BY ROBERT HUTCHISON, M.D., F.R.C.P. Pp. viii + 163. Bristol: John Wright & Sons, Ltd. 1926. Price 7s. 6d.

This little book, intended to lay down the general principles of treatment for medical students engaged in clinical training where the greater emphasis is properly laid on examination and diagnosis, has been built up from lectures on this subject given by Dr Hutchison at the London Hospital. A few of the chapter headings—fever, insomnia, constipation, diarrhoea, anæmia, nephritis, hæmorrhage, will indicate

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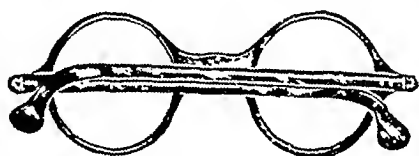
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the general plan of these lectures; and the treatment of each condition is discussed in a definite order of general management, diet, drugs. There are also separate chapters on endocrine treatment, bacteriotherapeutics, psychotherapy, and some minor medical operations. Numerous examples of prescriptions are given. The book is well adapted to serve its purpose; its clear, strictly defined plan is carried out in that dry, trenchant style of writing which we expect from the pen of Dr Hutchison, enlivened by his sarcastic humour, and by his very happy gift of quotation. And for the medical students entering hopefully this subject of the control and cure of disease, nothing could be more useful than the bracing air of cold logic and scepticism that is kept steadily blowing over it by the author.

Principles and Practice of Chemotherapy, with Special Reference to the Specific and General Treatment of Syphilis. By JOHN A. KOLMER, M.D. Pp. xv+1106, with 82 illustrations. London and Philadelphia: W. B. Saunders Company, Ltd. 1926. Price 55s.

This is a large volume which can be divided roughly into two portions, for the first 450 pages deal with chemotherapy in general, whilst the remaining 650 pages are devoted to the special problem of the treatment of syphilis.

The author gives a very full and excellent account of the treatment of syphilis, but this is a subject that has been fully treated in many monographs, and the special and novel interest of the volume lies in its first half in which is collected a mass of information that few if any previous writers have considered as a whole.

The author defines chemotherapy "as the prevention or treatment of disease by chemical disinfection or inhibition of the parasitic causes without marked or serious toxic effects." In accordance with this definition a wide range of drugs are described, the chief classes being the bactericidal, spirochæticidal, trypanocidal and anthelmintic drugs.

Professor Kolmer is well known for his remarkable industry and energy, and he has performed a useful service to the medical profession in collecting into a single volume an enormous amount of information from widely scattered sources. Thousands of references are given, the great majority of which refer to work that has appeared during the last decade. All who are interested in chemotherapy will therefore find this volume invaluable for reference purposes.

The book, however, is not an easy one to read, for the author naturally has had difficulty in arranging and digesting the vast mass of raw material collected, especially as the evidence available is of very varying value, and frequently is contradictory. Moreover, the fact that the first and second halves of the volume are concerned with distinct but allied subjects naturally leads to a certain amount of

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repetition, and one feels that the value of the work probably would be increased if these two portions were published as separate volumes, each of which would then be of more manageable size.

The Enlarged Prostate. By KENNETH M. WALKER, F.R.C.S. Pp. xi + 193, with 59 illustrations. London: Humphrey Milford. 1926. Price 12s. 6d.

In this monograph the author presents an eminently practical treatise on prostatic affections as met with in the later years of life. To the practical surgeon certain sections will specially appeal. One deals with the vitally important question of the management of cases presenting signs of renal insufficiency from chronic urinary obstruction. Another describes various lesions, apart from actual prostatic enlargement, which produce vesical neck obstruction, such as fibrous or hypertrophic Albarran's glands. Among other methods of treatment the author describes a special technique of his own for such conditions in which diathermy is combined with Young's punch operation. This book can be confidently recommended as a clearly expressed, concise and authoritative work.

Variations in the Form of the Jaws with Special Reference to their Etiology and their Relation to the Occlusion of the Dental Arches. By J. SIM WALLACE, M.D., D.Sc., L.D.S. Pp. xii + 265, with 84 illustrations. London: Baillière, Tindall & Cox, 1927. Price 17s. 6d.

This volume is a slight elaboration of the essay for which the Cartwright prize was awarded the author in 1925. It deals, as its title indicates, with a minute and localised portion of that vast and fascinating biological problem, the modifications of structure in the evolution of modern races. Congenital defects of either jaw are not considered, merely the deformations which might be, even remotely, related to the teeth.

The essay gives evidence of prolonged observation and the careful study of their results. Thus the *pièce de résistance* of a long chapter are post-natal development of the jaws in the repeated examination and taking of casts of the mouth of an individual from 3½ to 25 years of age. It is only by some such elaborate study that the vexed question of movements of the teeth in the alveolar processes during eruption can be definitely settled. We think Dr Wallace lays too much stress on mere eruption and occlusion. The soft parts take an appreciable share in the moulding and there are more subtle influences still. We share Dr Wallace's scepticism of the action of adenoids as a disturber of

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orthodontics, but we think he makes too much of the effects of the dummy rubber teat and of finger sucking in this respect.

In various places Dr Wallace writes of the "struggle for mastery" of one force over another, of a rivalry between pressure and tension. We think this suggestion of opposing forces an unfortunate way of expressing the natural co-ordination and mutual accommodation which ensure the normal evolution of each and every part.

The evils of modern child-life, often referred to throughout the book, seems more repellant as summarised on p. 240 and where one reads, "Modern civilisation, and especially the malselection of food, *often* converts the alimentary canal *from one end to the other* into a series of pathological specimens" (our italics) we are inclined to think there is exaggeration and that perhaps even the growth and formation or deformation of the jaws scarcely depend so much on the teeth as Dr Wallace seems to make out.

The essay is a contribution which does not come amiss, though to view the whole of the organism through a part may lead the author to some dangerous arguments and to some conclusions which would scarcely receive universal acceptance.

The book is creditably turned out. The letterpress is excellent and the illustrations good.

Infections of the Hand. By LIONEL R. FIFIELD, F.R.C.S. (Eng.). Pp. viii + 192, with 67 illustrations. London: H. K. Lewis & Co., Ltd. 1926. Price 9s.

It is a regrettable fact that few of the standard text-books give enough space to the surgery of the hand. The author has set out to supply this want. The book embodies the recent researches on the subject; and, in the arrangement and teaching, the author closely follows the masterly work of Kanavel.

The first 40 pages are devoted to surgical anatomy, which is clearly set forth and adequately illustrated. Commendable prominence is given to surface-marking. Each type of lesion, from the simplest to the most severe, is dealt with in turn; and their clinical aspects, differential diagnosis, and treatment discussed. The facts are stated concisely and without ambiguity; and the illustrations, which are good throughout, are in harmony with them. The two sections on infection of the palmar spaces are particularly valuable and instructive. This small book can be recommended strongly to senior students and to general practitioners who engage in surgery.

NEW EDITIONS

Practical Organic and Bio-Chemistry. By R. H. A. PLIMMER, D.Sc.
New Edition. Pp. x + 568, with coloured plate and 68 illustrations.
London: Longmans, Green & Co., Ltd. 1926. Price 21s.

This book, which has been justly popular for years, now appears in an enlarged and improved form. Originally drawn up as a handbook for practical work for medical students, it now contains a considerable amount of theoretical matter and has become a useful textbook of organic chemistry. The text commences with several chapters on methods of procedure necessary for isolating and recognising organic substances. Then follows systematically an account of the principal groups of organic compounds, emphasis being put on those of special importance in medicine. Here and there definite directions are laid down for the carrying out of practical experiments. The earlier chapters will serve the student of bio-chemistry and its physiological applications, while the later ones are of more interest to those doing clinical work. Considerable attention is given to the more complex chemistry of the changes accompanying metabolism and the respiratory exchange, and the pathological substances found in the blood and in the urine. We have every confidence that the present edition will maintain the position held by its predecessors. It can be confidently recommended to medical students for use throughout their whole course.

Applied Pharmacology. By A. J. CLARK, Professor of Pharmacology, Edinburgh University. Second Edition. Pp. 430, with 54 illustrations. London: J. & A. Churchill. 1927. Price 15s.

The favourable impression created by the first edition of Professor Clark's book has increased with the passage of time, and there can be no doubt of the great impulse it has given to the study of Pharmacology. For the author has clearly shown the correlation between the scientific study of drugs and their clinical effects in a manner never previously attained. The chapter on Arsenic and Antimony, to quote merely one instance, is typical of this, and we are given a satisfying scientific account of the mode of action of the organic Arsenicals, and at the same time a very complete clinical statement which includes therapeutic and toxic actions. The section on the Kidney is a very ample one, and reference is made to the still unsolved problem as to the real nature of renal secretion. Cushny's theory of threshold and non-threshold substances is fully explained, and the author alludes to the difficulties in accepting it in its entirety, as Maclean already has done in his volume on Renal Disease. But every chapter teems with most useful and suggestive information, and the book is

New Editions

one of those whose every page bears the mark of accurate, well-digested knowledge. A very few misprints do not detract from a volume, which no clinician can well afford not to read and reread.

Jacobi's Atlas of Dermochromes. Fourth Edition. By HENRY MACCORMAC, C.B.E., M.D., F.R.C.P. In two volumes. Pp. xviii + 186, with 324 illustrations. London: Wm. Heinemann. 1926. £5, 5s. the set.

Failing the opportunity of studying skin diseases clinically, the next best method of acquiring the knowledge is by the careful examination of accurate models. The plates in Jacobi's Atlas are excellent reproductions of models, and have a much wider sphere than a museum of casts can have. The Atlas has been famed for its beautiful reproductions, and the present edition is in keeping with former editions in this respect. The nature of the plates can be judged by the fact that one can easily diagnose the condition represented without referring to the print. Many new plates have been added, and a new arrangement made.

The modern tendency in books on dermatology is to devote more and more space to syphilis, and this practice is followed in the Atlas, a large proportion of the plates being given to different manifestations of cutaneous syphilis. In this section the plates showing extra-genital chancres are specially useful, as these not infrequently escape recognition.

Dr MacCormac has written a new text giving the main points in the description of the diseases shown, and dealing briefly with their aetiology, the various theories of the causation of the different conditions being mentioned, and also indicating their treatment. The book can be thoroughly recommended.

NOTES ON BOOKS

The Early Diagnosis of the Acute Abdomen, by Zachary Cope, M.D., F.R.C.S., fourth edition (Milford, 10s. 6d.), has now attained an established position. It is recognised as a reliable guide to the early diagnosis of acute abdominal conditions. The present edition shows few changes from its predecessors, the chief addition being a short section on mesenteric thrombosis and embolism. We are glad to see that the author, in spite of criticism, adheres to his position in distinguishing a stage of shock as the initial stage in perforation of a gastric or duodenal ulcer.

A new edition of *An Atlas of Human Anatomy*, by Carl Toldt, M.D., has been edited by M. Eden Paul, M.D. (Brux.), M.R.C.S.,

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L.R.C.P. (The MacMillan Company, price 42s.). Each section is furnished with appendix which contains references to other authorities concerning the more intricate points, and should be especially useful to advanced students. In the section dealing with angiology there is sometimes a lack of definition of those muscles which lie in direct relationship with the vessels, e.g., in Fig. 1023 where it is difficult to make out the deep relations of the radial artery. Taken on the whole, however, the atlas is an excellent one. As is pointed out in the translator's preface, a knowledge of anatomy can only be obtained in the dissecting room. Illustrations are instructive chiefly when used in conjunction with actual specimens, and there is a real danger in relying too much on the former and too little on the latter.

The Artificial Light Treatment of Children: in Rickets, Anæmia, and Malnutrition, by Katherine M. L. Gamgee, M.R.C.P., D.P.H. (Lewis, 10s. 6d.), is written by a careful observer, from experience gained at a Municipal Light Clinic. It should therefore appeal especially to the Public Health Worker, to whom it may be cordially recommended as a safe guide in inaugurating and in carrying on a light clinic for the pre-school child. A few of the many aspects of the subject described by the writer are, the choice of premises, staffing, equipment, and apparatus; the dosage, and therapeutic action upon the child as compared with the adult; the types of case suitable for treatment—apart from tuberculosis, which is only briefly referred to; and the importance of not omitting regular height, weight, and hæmoglobin estimations in assessing progress.

The Psychopathology of Tuberculosis, by D. Y. Macleod Munro (Milford, 5s.), attempts to give an outline of the various mental states from which a tuberculous patient may suffer. These are well known to all who have to deal with the treatment of tuberculosis and no fresh views are expressed. Short biographical notes are given concerning several well-known literary geniuses who suffered from pulmonary tuberculosis.

The title of *Why Tuberculosis Exists: how it can be and has been cured and prevented*, by R. Goulburn Lovell (John Bale, Sons & Danielsson, Ltd., 6s.), is misleading because it does not indicate that the whole book is a rehash of the Spahlinger question. We cannot recommend it to our readers as no fresh facts are brought to light. The composition and mode of manufacture of the complete serum and vaccine are still withheld.

The following books are published by Messrs H. K. Lewis & Co.:—

X-Ray Apparatus: Its Arrangement and Use, by P. K. Bowes, M.A., B.Sc. (7s. 6d. net.), gives an excellent account of elementary magnetism and electricity, and of the construction of dynamos and motors, trans-

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formers and induction coils; also of the X-ray tube and the various measuring instruments in common use. It can be recommended to nurses and others who are preparing for an examination in radiography.

Ultra-Violet Rays in General Practice, by W. Annandale Troup (4s. 6d.), adds another to the increasing number of books on ultra-violet radiations. A disproportionate amount of the book is given to the description of apparatus. The part dealing with the physics of ultra-violet rays is contradictory in some places, wrong in others. Some of the statements in the chapter on therapeutic application are contrary to facts. The author's zeal has outrun his judgment.

An Introduction to the Law and Tradition of Medical Practice, by William Sanderson, M.A., LL.B., and E. B. A. Rayner, B.A., LL.B. (7s. 6d.), is intended as a handy companion to a more complete treatise on the same subject by the authors. It not only summarises the common and statute law bearing on medical practice, medical tradition and medical ethics and etiquette, but also gives a brief account of the nature, and practice, and administration of law. Citations from law cases are given in foot-notes. The text itself is a model of concise and luminous statement. The book can be warmly recommended to medical practitioners.

Wheeler's Handbook of Medicine, by William R. Jack, M.D., B.Sc. (Livingstone). That this book should have reached its eighth edition, three new editions having been brought out since 1920, is witness to its popularity. It is a convenient primer for the beginner in medicine.

The Modern Treatment of Hemorrhoids, by Joseph F. Montague, M.D., F.A.C.S. (Lippincott). The size of this monograph is out of proportion to the information it gives; and in so large a book one is disappointed to find no account of the anatomy and physiology of the parts under consideration. The discussion of signs and symptoms is thrust upon the reader before the etiology and pathology are dealt with, and the reader is wearied by repetition and colloquialisms. In striking contrast, however, are the sections on physical examination, diagnosis and treatment, which are clearly explained and illustrated. The part dealing with treatment will have the widest appeal; it can be confidently recommended. All methods are discussed, the indications for each are stated, and the author's preferences are given. The technique of the injection method of treating hemorrhoids is particularly well described.

Electrical Accidents, by Prof. Stephan Jellinek, second edition (Vienna, Franz Deuticke, price 8s.). This book (written in German) is intended for engineers and doctors. It explains how injuries, fatal

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and otherwise, may occur by carelessness on the part of the individual or by accidental short circuits, etc. It also shows the risks run by electrical engineers and doctors who may have to work apparatuses where heavy electric currents are used. The book is well illustrated and will be most useful for electrical engineers and for doctors who have to work with powerful currents or who are liable to have to attend patients injured by electricity.

The Mind in Disease, by M. P. Leahy, B.A., M.B. (Heinemann, Ltd., price 6s.). The author of this book was wounded at Mons in 1914, and spent ten months afterwards as a prisoner of war. While in prison he had his right leg amputated, was reduced from 12 to 8 stone and required 2 grains of morphia per day for pain. In addition he slept badly and suffered from severe pain in his wound with profound depression. He had eight operations and lay in bed longing for death. He describes how he cured himself by suggestion and records a large number of other cases cured or relieved by the same method. The writer is very enthusiastic about what can be done by suggestion alone. He makes little attempt to analyse the nature of the troubles he has dealt with, but in a list of conditions cured by himself he includes alcoholism, asthma, confusion states, epileptiform fits, hay fever, migraine, morphomania, melancholia and various phobias.

NOTES

A QUARTERLY MEETING of the College was held on 3rd May 1927, Dr G. M. Robertson, President, in the Chair. The Royal College of Physicians of Edinburgh. Dr John Robert Lord, C.B.E., and Dr William Bell were introduced and took their seats as Fellows of the College. Walter Duncanson Chambers, M.D., was elected a Fellow of the College. Arthur Mills, M.D. St Andrews, Harold Edward Whittingham, M.B. Glasg., Ram Swarup Gupta, M.B. Allahabad, James Davidson, M.B. Edin., James Alexander Law Loudon, M.B. Edin., William Lindsay Kinnear, M.D. St Andrews, and Raymond Leopold Albert Kitchen, L.R.C.P. Edin., were elected Members of the College. Dr Robert Alexander Fleming was nominated a Representative on the Conjoint Committee of Management of the Triple Qualification.

The *Parkin Prize* was awarded to Dr John Dixon Comrie.

The *Freeland Barbour Fellowship* was awarded to Dr Thos. Robt. Rushton Todd.

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Notes

At a Meeting of the College held on 17th May, Dr A. Logan Turner, President, in the Chair, the following
Royal College of Surgeons of Edinburgh. were admitted Fellows: James N. Adam, M.B., Ch.B. Edin.; Harold G. Armstrong, M.B. Toronto, M.C.P. & S. Ontario; Thomas O. Chenoweth, M.B., B.S. Melbourne; Arthur L. Clowes, M.B., Ch.B. Sydney; Amos H. Coleman, M.B., Ch.M. Sydney; Kenneth A. Gilchrist, M.C., M.B., Ch.B. Edin., D.P.H., R.F.P. & S. Glasg.; Alexander Campbell Gillies, M.B., Ch.B. Edin.; Prabhakar N. Gokhale, M.B., B.S. Bombay, D.O.M.S. Lond., D.O. Oxford; Norbertus D. P. de V. Graaff, M.B., Ch.B. Edin.; George M. Gray, M.B., Ch.B. Aberd.; John F. Hackwood, M.R.C.S. Eng., L.R.C.P. Lond., M.B., B.S. Lond.; William K. R. Hamilton, M.B., Ch.B. New Zealand; Brian M. Johns, M.B., Ch.B. New Zealand; Balwant G. Kane, M.B., B.S. Bombay; John Joseph Kelly, M.B., B.S. Melbourne; Harry Lewis, M.B., Ch.B. Edin.; Arthur N. M'Millan, M.R.C.S. Eng., L.R.C.P. Lond.; Ruth E. Millar, M.B., Ch.B. Edin.; Boddapati T. Rao, L.M. & S. Madras, L.R.C.S.E. (Triple); Malcolm S. Ross, M.B., Ch.B. Edin.; Robert R. Simpson, M.B., Ch.B. Glasg.; Ahron Sourasky, M.B., Ch.B. Leeds, M.R.C.S. Eng., L.R.C.P. Lond.; William C. Wilson, M.B., Ch.B. Edin.

THE following candidates received the Higher Dental Diploma: William G. Coventry, L.D.S. Birmingham; Clarence V. Berry, L.D.S. Eng.; Edwin Priestly, L.D.S. Liverpool.

The *Bathgate Memorial Prize*, consisting of Bronze Medal and Set of Books, was after a competitive Examination in Materia Medica, awarded to: Mr Chee Juay Poh, Edinburgh; Mr Demetrius Maurice O'Flaherty, Edinburgh, who obtained equal marks.

BOOKS RECEIVED

- | | |
|--|-----------|
| BEESLY, LEWIS, and T. B. JOHNSTON. A Manual of Surgical Anatomy. Third Edition (<i>Humphrey Milford, Oxford University Press</i>) | 18s. net. |
| BODANSKY, MEYER. Introduction to Physiological Chemistry. (<i>Chapman & Hall, Ltd., London</i>) | 20s. net. |
| CURTIS, ARTHUR H. (Edited by). Transactions of the American Gynecological Society—Volume 51. For the year 1926. (<i>The Mosby Company, St Louis</i>) | — |
| DE LEE, JOSEPH B. Obstetrics for Nurses. Eighth Edition. (<i>W. B. Saunders Company, Ltd., London and Philadelphia</i>) | 15s. net. |

Books Received

- GRIFFITH, J. P. CROZER, and A. GRAEME MITCHELL. The Diseases of Infants and Children. Two volumes. Second Edition.
(*W. B. Saunders Company, Ltd., London and Philadelphia*) 90s. net. per set
- HANNAN, JOHN H. The Flushings of the Menopause.
(*Baillière, Tindall & Cox, London*) 3s. 6d. net.
- HEBERT, G. T. Pulmonary Tuberculosis.
(*Edward Arnold & Co., London*) 7s. 6d. net.
- HERRICK, C. JUDSON. An Introduction to Neurology. Fourth Edition.
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- LUCAS, WILLIAM PALMER. The Modern Practice of Pediatrics.
(*J. & A. Churchill, London*) 30s. net.
- BY MEMBERS OF THE HOSPITAL STAFF. The Queen Charlotte's Practice of Obstetrics (*J. & A. Churchill, London*) 18s. net.
- MACKENNA, ROBERT W. Diseases of the Skin. Second Edition.
(*Baillière, Tindall & Cox, London*) 25s. net.
- MINET, E. P., and A. G. M. SEVERN. Practical Tropical Sanitation. Second Edition (*Baillière, Tindall & Cox, London*) 5s. net.
- Forty-Ninth Annual Report of the Department of Health of the State of New Jersey, 1926. —
- PARRY, LEONARD A. Some Famous Medical Trials.
(*J. & A. Churchill, London*) 10s. 6d. net.
- PINEY, A. Recent Advances in Hæmatology.
(*J. & A. Churchill, London*) 12s. 6d. net.
- ROCHE, ALEX. E. Pyelography . (*H. K. Lewis & Co., Ltd., London*) 9s. net.
- ROMANIS, W. H. C., and PHILIP H. MITCHINER. The Science and Practice of Surgery. Volume I. . (*J. & A. Churchill, London*) 14s. net.
- ROMANIS, W. H. C., and PHILIP H. MITCHINER. The Science and Practice of Surgery. Volume II. . (*J. & A. Churchill, London*) 14s. net.
- RUNDLE, CLAUDE (Revised by). Ker's Manual of Fevers. Third Edition. . . . (*Humphrey Milford, Oxford University Press*) 12s. 6d. net.
- SINCLAIR, MEURICE. The Thomas Splint.
(*Humphrey Milford, Oxford University Press*) 15s. net.
- SOLLMANN, TORALD. A Manual of Pharmacology. Third Edition.
(*W. B. Saunders Company, Ltd., London and Philadelphia*) 35s. net.
- STERN, BERNHARD J. Social Factors in Medical Progress.
(*Columbia University Press, New York*) \$2.25
- STEWART, F. H. Segregation and Autogamy in Bacteria.
(*Adlard & Son, Ltd., London*) 7s. 6d. net.
- STRICKLER, ALBERT. Textbook on Diseases of the Skin and Syphilis.
(*F. A. Davis Company, Philadelphia*) \$8.00 net.
- THEOBALD, G. W. Normal Midwifery.
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- Transactions of the American Gynecological Society, General Index, Vols. I to L (1876-1925) inclusive. —
- TRAQUAIR, H. M. An Introduction to Clinical Perimetry.
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THE PLACE OF SURGERY IN THE TREATMENT OF DISEASES ASSOCIATED WITH ENLARGE- MENT OF THE SPLEEN.*

By D. P. D. WILKIE, M.Ch., F.R.C.S., Professor of Surgery, University
of Edinburgh.

UNTIL quite recent times the interest of surgeons in the spleen

The Transactions of the Medico-Chirurgical Society of Edinburgh

SESSION CVI.—1926-1927

holds out in certain groups of cases, and the surgeon must in this field be essentially an operating physician.

It would be tedious to pass in review all the functions which have at one time or another been attributed to the spleen. We now know that it plays an important role in destroying effete red blood corpuscles and blood platelets. It is an important part of the reticulo-endothelial system and possesses in its ellipsoids very efficient blood filters and in its reticulum groups of cells with remarkable phagocytic properties. It thus plays no negligible part in combating systemic infection, and in certain diseases, such as malaria and typhoid, this function is all-evident.

* Read 2nd March 1927.

Books Received

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| <p>GRIFFITH, J. P. CROZER, and A. GRAEME MITCHELL. The Diseases of Infants and Children. Two volumes. Second Edition. (W. B. Saunders Company, Ltd., London and Philadelphia)</p> | 90s. net. per set |
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THE PLACE OF SURGERY IN THE TREATMENT OF DISEASES ASSOCIATED WITH ENLARGEMENT OF THE SPLEEN.*

By D. P. D. WILKIE, M.Ch., F.R.C.S., Professor of Surgery, University of Edinburgh.

UNTIL quite recent times the interest of surgeons in the spleen had centred mainly in the operative treatment of traumatic rupture of the organ and the rare cases of torsion of a wandering spleen. Increasing knowledge of the functions of the spleen and thus of the role which it possibly played in diseases in which it was manifestly enlarged encouraged surgeons to attempt removal of the organ in cases of splenomegaly. A phase of what was in fact experimental surgery then set in, and the effect of splenectomy on the course of diseases associated with splenomegaly was studied in many series of cases with great care and intensive observation. Sufficient data have now accumulated to permit us to review the subject with a measure of confidence, whilst recognising how far we are from anything approaching finality.

This is essentially a borderland subject, in the treatment of which co-operation between the physician and the surgeon must be constant and intimate to ensure the maximum of benefit to patients and to further progress in medical science. Thus the physician must be familiar with the possibilities which surgery holds out in certain groups of cases, and the surgeon must in this field be essentially an operating physician.

It would be tedious to pass in review all the functions which have at one time or another been attributed to the spleen. We now know that it plays an important role in destroying effete red blood corpuscles and blood platelets. It is an important part of the reticulo-endothelial system and possesses in its ellipsoids very efficient blood filters and in its reticulum groups of cells with remarkable phagocytic properties. It thus plays no negligible part in combating systemic infection, and in certain diseases, such as malaria and typhoid, this function is all-evident.

* Read 2nd March 1927.

D. P. D. Wilkie

The experiments of Tait and his co-workers have demonstrated the remarkable capacity of the ellipsoids, in which the terminal branches of the splenic artery end, to catch any particulate matter in the circulating blood, and the ingestion of particles so arrested by the branching phagocytic cells which abound in the reticulum of the splenic pulp. They have further shown that the circulation of the spleen is definitely segmental, a fact which suggests that partial resection of the organ in cases of injury might often be possible. The interesting demonstration that the left phrenic nerve contains fibres passing to the splenic vessels may be partly responsible for the pain in the left shoulder experienced in splenic disease.

Under certain pathological conditions the spleen may assume again its foetal role of forming white blood corpuscles and may throw large numbers of these into the circulation.

The work of Barcroft has proved that the spleen is an important blood reservoir, and the size of lumen and exceptional contractile power of the splenic vein exercise a very resilient control on the discharge of blood from this organ into the circulation. The relatively large amount of blood which passes through the spleen and returns by the portal circulation through the liver suggests some close relationship in functional activity between these organs, and the relief which removal of the spleen might give to an embarrassed portal circulation from hepatic cirrhosis. Further, any toxic products which might be formed in the spleen in pathological conditions must first perfuse the liver before entering the systemic circulation, so that secondary hepatic changes might be almost expected in some forms of splenic disease.

Infective Diseases of the Spleen.—But rarely is surgical interference indicated in such diseases. The *septic infarct* of the spleen is of interest chiefly because the acute pain associated with the condition is liable to be mistaken for a perforation demanding immediate operation. The presence of endocardial disease will, as a rule, leave little doubt as to diagnosis. Solitary abscess of the spleen is very rare but on occasion may require drainage by operation.

Splenic tuberculosis, either in the form of multiple caseating nodules in a slightly enlarged spleen or as a diffuse fibrous hyperplasia with considerable enlargement of the organ, may constitute the one important active tuberculous focus in the body. In certain cases, almost all among children, removal

Surgery of the Spleen

of the tuberculous spleen has led to a favourable termination of a long febrile illness. It is but right, therefore, where a splenic enlargement is associated with intermittent fever and no other gross tuberculous lesion can be discovered, to consider the question of splenectomy.

Syphilis of the Spleen.—Mayo first drew attention to the fact that the spleen may be the fastness in which the spirochæte may lodge and defy all specific drug treatment. He showed that removal of the spleen, which in such cases is firm and fibrotic and usually just palpable, will permit of rapid cure by medicinal means.

Malaria.—Removal of the spleen has frequently been considered for intractable cases of malaria. The procedure would appear to be a rational one, and it has been carried out successfully in some cases. The final opinion of those best qualified to judge is, however, that efficient medicinal treatment, aided by X-rays, will effect a cure in the class of case which some years ago might have been considered suitable for operation.

Cysts and Primary Tumours of the Spleen.—Hydatid cyst of the spleen and sarcoma are very rare conditions, for both of which surgical treatment is indicated. So seldom are they met with, however, that they may be regarded as curiosities.

The Splenomegalies.—A large number of diseases, some well-established entities, others less well defined, may be classed together in that they present among other features an enlargement of the spleen.

In one group, which we may term the primary splenomegalies, the enlargement of the spleen forms the striking feature of the clinical picture. In this group I would include Banti's disease, Egyptian splenomegaly and Gaucher's disease. In the other group, which we may call the secondary splenomegalies, an abnormal state of the blood is the characteristic feature, and the splenic enlargement a secondary or constant phenomenon. This group will include the leukæmias, pernicious anæmia, von Jaksch's disease, hæmolytic jaundice, purpura hæmorrhagica and polycythæmia vera. In some cases an exact diagnosis is by no means easy. It is fortunate, however, that in the conditions now proved to be susceptible to surgical treatment diagnosis can usually be made with accuracy. I propose to refer briefly to each of these diseases in relation not so much to diagnosis as to the possibilities of surgical relief.

D. P. D. Wilkie

Splenic Anæmia or Banti's Disease.—Most authorities are now in agreement that the two names given above are synonymous, Banti's disease with its cirrhosis of the liver being merely the late stage of what some would term simple splenic anæmia. No definite cause for the disease has as yet been discovered, but all evidence points to there being some form of primary infection in the spleen which results in the splenitis, perisplenitis and endophlebitis of the splenic vein so characteristic of the disease. Cultures from the spleen made in 82 cases operated on in the Mayo Clinic were negative in every instance.

The disease is one of adult life and passes through three definite stages. These stages show the following clinical pictures :—

- 1st stage—anæmia of secondary type with enlarged spleen palpable below the costal margin—duration one to eight years.
- 2nd stage—hepatic enlargement, tinge of jaundice, hæmatemesis, gastro-intestinal disturbance.
- 3rd stage—small cirrhotic liver, large spleen, jaundice, ascites, hæmatemesis, marked anæmia, recurrent fever, progressive weakness.

The results of splenectomy in this disease have been on the whole most gratifying and have done much to support the belief that a very chronic infective process in the spleen is the essential cause of the changes which develop in the later phases of the disease.

As one might anticipate, the results are best when operation is undertaken in the first or second stages of the disease, when, with an operative mortality of less than 10 per cent., a complete cure may be effected. Even in the late stage operation may effect a marked improvement but is associated with an operative mortality of almost 50 per cent. The largest single series of cases reported is that from the Mayo Clinic, dealing with 82 cases, some of them in the late stage of the disease, with an operative mortality of 11 per cent.

It has been noted repeatedly, however, that whilst in one case signal success followed removal of the spleen, in another apparently equally early case death followed the operation, the cause of death being frequently mesenteric thrombosis. Howell Evans has shown that cases of this disease may be

Surgery of the Spleen

divided into two groups—those with a low platelet count, and those with a normal or a high platelet count. The former respond well to splenectomy, the latter show a great tendency to thrombosis after removal of the spleen. As the operation of splenectomy is always followed by a marked, if temporary, rise in the platelet count, Dr Evans's grouping of cases of Banti's disease is of great practical importance.

The operation presents two main difficulties. In some cases extensive and dense perisplenic adhesions may hamper removal, and in freeing the spleen considerable hæmorrhage and shock may result. The second difficulty is with the splenic vein, which is friable from endophlebitis and may tear when ligatured. Special care will obviate this complication. When operation is performed in the late stage of the disease in the presence of hepatic cirrhosis and ascites, the combination of omentopexy with splenectomy, as advised by Tansini, appears rational and has been performed with success in a number of cases. Blood transfusion should be carried out both before and after operation in all advanced cases.

Egyptian Splenomegaly, which is closely analogous to Banti's disease, is equally benefited by splenectomy. In the series of 70 cases reported by Coleman and Bateman the results following splenectomy were excellent. In this series there were 11 deaths, a mortality of 15.7 per cent.

Gaucher's Disease.—This disease, characterised by an enormous enlargement of the spleen but no very characteristic blood picture, merely an anæmia of secondary type and leucopænia, was described by Gaucher as a neoplasm of the spleen—splenic epithelioma. The masses of cells which he described are now known to be endothelial in origin. The disease occurs early in life, usually in girls, and it tends to run in families. Some discoloration of the face, neck, and hands and a thickening of the conjunctiva on either side of the cornea are commonly present. The disease runs a slow and indolent course, and the patients may survive in more or less indifferent health for years.

Splenectomy in this disease is followed by a very definite improvement in the patient's general condition and a relief from the local discomfort due to the large spleen. Guillot has recorded 14 cases of Gaucher's disease treated by splenectomy. There were three deaths, but the results in the eleven patients who survived were extremely satisfactory.

D. P. D. Wilkie

Blood Diseases with Splenomegaly.—*Hæmolytic Jaundice.* Pride of place is given to this disease because, of all the blood dyscrasias associated with enlargement of the spleen, it is foremost in the list of successful splenectomies. The relief following operation in this condition is so dramatic as to be almost unbelievable until actually witnessed.

Two types of the disease are met with—the congenital or familial type described by Minkowski, and the acquired type described by Hayem and Vidal. Whilst the cause of the disease is still obscure, its clinical features are now well known. Briefly they are: a moderate splenic enlargement, the spleen being just palpable, a definite icteric tinge of the skin and conjunctiva, absence of bile in the urine and presence of bile in the stools. Bile recovered from the duodenum by the duodenal tube shows an increase of urobilin and the presence of urobilinogen (Schneider's test). Van den Bergh's test gives the indirect reaction. The red blood cells show an abnormal fragility as tested by their resistance to hypotonic saline solution. The fragile red cells are destroyed in great number in the spleen and from the hæmoglobin liberated bile pigment is formed in excess; hence the great tendency to the formation of pigment gallstones in this disease. At the Mayo Clinic it was found that gallstones were present in 60 per cent. of cases of hæmolytic jaundice coming to operation. From this one can understand how a difficulty in diagnosis may arise, as such patients may suffer from biliary colic and even obstructive jaundice superimposed on the hæmolytic type.

In the familial type of this disease, whilst operation is not imperative, it should always be considered. Patients with congenital hæmolytic jaundice may live to a moderate age, suffering merely from occasional attacks of fever with some increase of jaundice. In not a few cases, however, increasing anæmia develops in early adult life, accompanied by asthenia, and death from some intercurrent affection. Removal of the spleen will banish the lifelong jaundice and lead to a remarkable improvement in general health. In the records of several families in which this disease has been present there has been striking testimony to the benefit of splenectomy in that one member after another has requested operation on the evidence of improved health in the splenectomised relatives.

In the acquired type of the disease surgical intervention is urgently demanded. This type develops in adolescence or

Surgery of the Spleen

early adult life and frequently runs a rapid course, punctuated by crises of fever, pain, and deepened jaundice. The latter suggest strongly attacks of cholangitis associated with stone in the common duct. Even when the jaundice is pronounced, itching of the skin is never present. It would seem that the crises are due to hæmolytic activity on a massive scale, throwing an acute strain on all the blood-producing organs.

The diagnosis as a rule is not difficult; only when gallstones complicate the case is there any real doubt. In a few cases the suspicion of pernicious anæmia may arise, but in the latter the fragility of the red cells is not increased, the spleen is not so large, and the blood film and count are more or less decisive.

There is only one treatment for hæmolytic jaundice and that is splenectomy. This operation, which presents in this disease no special difficulties, by extirpating the organ which is responsible for breaking up and destroying the fragile red cells, is followed immediately by the disappearance of all the signs and symptoms of the disease.

The operation mortality is not high. In a series of 137 cases collected by Krumbhaar the operative mortality was 2.9 per cent.

Purpura Hæmorrhagica.—In chronic purpura there is frequently splenomegaly and there is a marked diminution of the blood platelets. As the blood platelets are destroyed by the cells of the reticulo-endothelial system and particularly by those of the spleen, it seemed feasible that removal of the enlarged spleen might be of benefit in this condition.

In 1916, Kaznelson recorded the first splenectomy for chronic purpura. The result was brilliant, and since then large numbers of successful results have been reported.

Accurate diagnosis is essential before recommending operation. The patient is usually pale and asthenic, suffers from severe cutaneous and mucous hæmorrhages, and has recurring fever and some enlargement of the spleen. Whipple insists on the following five findings before accepting the diagnosis: (1) a low platelet count; (2) a prolonged bleeding time; (3) a failure of the clot to retract; (4) a normal clotting time; (5) the appearance of petechiæ in the skin of an extremity below an elastic tourniquet so applied as to retard venous return but not to interfere with arterial inflow.

Kaznelson believes that the blood platelets are formed in normal numbers but are destroyed by over-active phagocytosis

in the enlarged spleen, and the results of splenectomy tend to support his view.

Following the operation the patient rapidly regains a sense of health and well-being, the pallor disappears, the bleeding from nose and gums ceases, the bleeding time returns to normal and the platelets rise from almost zero to 200,000-600,000.

Whipple has recently collected a series of 73 cases of chronic purpura treated by splenectomy. There were 6 post-operative deaths (8.2 per cent.). Of 61 cases followed up, the result was very good in 51. We may therefore class the operation of splenectomy in chronic purpura as one of the triumphs of modern surgery.

We now come to a series of blood diseases in which the indications for splenectomy are much less certain and are still the subject of serious debate.

Pernicious Anæmia.—The success of splenectomy in certain other conditions associated with blood dyscrasias and the hopelessness of medical treatment to cure this disease has tempted surgeons to test the effect of removal of the spleen in cases of pernicious anæmia.

At the outset we are faced with the discouraging fact that the spleen is seldom much enlarged in this disease, and its condition does not form one of the salient features in the pathological or clinical picture. At the same time we know that many immature and imperfect red cells are thrown into the circulation and that probably many of those perish in the spleen.

Mayo, Percy, and others formulated a line of treatment based on the supposition that the disease is due to a poisoning which acts both on the circulating red blood corpuscles and on the hæmopoietic organs. This treatment was based on three factors: (1) an attempt to stimulate the formation of new blood by massive step-ladder transfusions; (2) an attempt to overcome the absorption of hæmolytic bacteria or their toxins by the radical removal of local foci of infection, *e.g.*, in mouth, air sinuses or abdomen; (3) an attempt to protect the newly-formed and older red cells by removal of the spleen.

Since 1913, when several cases of improvement following splenectomy for this disease were reported, more than 300 cases have been recorded. Whilst the results are on the whole disappointing, and in the majority of instances little if at all better than those obtained by medical measures, they are not

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so wholly bad as to rule out the question of operation entirely. The largest single series of cases recorded is that from the Mayo Clinic. Mayo records 61 cases. In the first 19 cases, where the operation was performed as a last resort and without preliminary blood transfusion, there were 3 operative deaths. In the next 42 cases, prepared by blood transfusion, there were no operative deaths. An immediate improvement following the operation was the rule. About 22 per cent. of the patients lived two and a half times as long as those in a parallel series of unoperated cases. About 10 per cent. lived more than five years and were able to work. Mayo concludes that in the more chronic types of the disease and in young patients splenectomy is well worth performing. In elderly patients and in the aplastic types of pernicious anæmia operation should never be recommended.

Leukæmia.—In the opinion of many physicians surgery has no place in the treatment of the leukæmias. Certainly in the acute forms of this obscure disease surgical treatment is not indicated.

In the chronic types, both the lymphatic and the myelogenous, but notably in the latter, there is enlargement of the spleen, and in view of the gloomy outlook offered by medical treatment many surgeons have attempted by removal of the spleen to influence the course of the disease. It must be confessed that the initial efforts of surgery were by no means encouraging, and the operative mortality at one time approached 90 per cent. Of recent years, however, advantage has been taken of the very favourable if temporary influence of radiation of the spleen to operate during the period of improvement following radiotherapy. This factor, together with improvement in technique, has brought about a notable improvement in the immediate results of operation. The best results are those from the Mayo Clinic, namely 33 cases, of which 31 had preliminary radiotherapy with only one operative death, *i.e.* 3 per cent. In the majority of cases the good results following operation are but temporary, lasting for approximately one year. The Mayo Clinic results, however, are encouraging, as of the 33 patients mentioned above, 4 returned to work for five years, eight for more than three years. In all cases the condition of the blood improved, but in no case did it return to normal. The longest survival after operation was seven and a half years. The consensus of opinion at present is that in the majority of cases of splenomedullary leukæmia medical

treatment with radiotherapy is indicated, but that in selected cases in youthful individuals operation in a period of improvement after radiation will prolong life and give greater comfort but will not cure.

Von Jaksch's Disease.—This disease, also known as infantile splenomegalic anæmia, is now regarded more as a clinical syndrome than as a pathological entity. Occurring in infancy, it is characterised by a palpable enlargement of the spleen, slight increase in the size of the liver, a marked diminution in the number of red cells, with nucleated reds, poikilocytosis and polychromasia, and along with this a marked lymphocytosis. The child looks anæmic, develops œdema and shows a tendency to hæmorrhage from the nose, gums, and bowels. Most authorities regard this disease as an unusual form of secondary anæmia, and medical measures will usually effect a cure.

Ashby and Southam have recorded good results from splenectomy in cases resisting medical treatment, including radiotherapy. By removing the spleen, which is a possible source of poison and an important factor in the hæmo-destructive process, it is hoped to restore the normal balance between blood cell formation and destruction.

Polycythæmia Vera.—Whilst favourable results have been reported following splenectomy in this disease by Mayo, Lambert, and Delauney, it is difficult to formulate any rational basis for the removal of the spleen. The plethoric aspect of the patient, the great increase in the number of red cells and in the total blood volume—signs of an increased activity in all the erythrocyte-forming organs—would appear to make the retention of a blood-cell destroying organ such as the spleen eminently desirable.

In my experience patients suffering from this disease are very convenient blood-donors to patients requiring splenectomy for one or other of the anæmic types of splenomegaly but should not be subjected to the operation themselves.

Cirrhosis of the Liver.—In cases of Laënnec's cirrhosis with portal congestion and ascites, considerable success has attended the various forms of omentopexy which are grouped under the name of the Talma-Morison operation. When we consider the remarkable amount of blood which circulates through the spleen and is returned through the liver, it is reasonable to suppose that the cutting out of this part of the portal circulation might give considerable relief to the congested

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portal area. Following Tansini, some surgeons have combined splenectomy with omentopexy in the treatment of ascites from cirrhosis with results which are satisfactory if not brilliant. In Hanot's cirrhosis splenectomy is not indicated.

In conclusion we may state that splenectomy has now an established place in the treatment of certain diseases characterised by splenomegaly, namely in acquired hæmolytic jaundice, in chronic purpura, in splenic anæmia, and in Gaucher's disease.

In certain diseases it may be carried out with benefit in a few selected cases, namely in splenomedullary leukæmia, in pernicious anæmia, in von Jaksch's disease and in tuberculous and syphilitic splenomegaly.

In a third group of diseases in which enlargement of the spleen is found the operation is not indicated, namely malaria, polycythæmia vera, and acute leukæmias.

DISCUSSION.

Mr Graham referred to the details of a case of splenic anæmia treated by splenectomy, with special reference to the changes in the blood after operation. The patient, a woman of 46, had been a confirmed invalid for eight years and for most of that time had been confined to bed. She complained of weakness, palpitation, and a tendency to fainting on the least exertion, and at frequent intervals suffered from toxic symptoms with muscle pains and headache. Examination of the blood immediately prior to operation showed the typical picture of a severe secondary anæmia. R.B.C.s 2,800,000; Hb 38 per cent.; and colour index 0.68. The film showed a marked alteration of the red corpuscles with numerous microcytes and some megalocytes. Almost all the cells were distorted and poor in hæmoglobin. At the operation nothing abnormal was found in the abdomen apart from the greatly enlarged spleen which was removed. There was little loss of blood and the operation was well borne. One week after operation the blood film was unaltered, there was a leucocytosis of 15,000 and the hæmoglobin was reduced to 32 per cent., the colour index remaining low, 0.68. Two weeks after operation the film showed improvement in the size and shape of the cells and there were many nucleated reds; the hæmoglobin was now raised to 42 per cent. and the colour index from now onwards was normal. Three weeks after operation the film was still further improved and the hæmoglobin was 50 per cent. Four weeks after operation the appearance of the red cells was quite normal and the hæmoglobin was 53 per cent. The patient left hospital at the end of the sixth week with the hæmoglobin 65 per cent. When seen at the end of six

months all signs of anæmia had disappeared and the hæmoglobin estimation was 87 per cent. From these facts it was obvious that the effect of the splenectomy had been to cause a rapid disappearance of the abnormal corpuscles and their replacement by normal corpuscles. If one attempted to draw conclusions from the observations in this case they would be that the presence of the splenic enlargement had been responsible for some interference with the functions of the bone marrow, that immature corpuscles were being produced more readily destroyed than normal, and that the removal of the spleen almost at once permitted the bone marrow to resume its normal function. Although we are ignorant of the original cause of the splenic enlargement in splenic anæmia, the case suggested an explanation of why benefit is likely to follow removal of the spleen. If the spleen could be shown to influence the bone marrow in pernicious anæmia in the same way the indications for splenectomy in pernicious anæmia would be clear; but the evidence rather points in the contrary direction, and it seems generally accepted that the involvement of the bone marrow is primary. If again it could be shown that hæmolysis was particularly active in pernicious anæmia and that the destruction of corpuscles was mainly due to that feature then there might be another reason for considering splenectomy. Although not qualified to speak on this aspect of the subject, the fact that normal red corpuscles of the donor can be easily distinguished in the film a week or ten days after transfusion in cases of pernicious anæmia rather suggested that the hæmolytic activities of the organs and of the spleen were not specially increased. These objections to splenectomy in pernicious anæmia are based on theory and one would not be unduly influenced by them if the practical results of operation were encouraging. Sufficient cases have now been recorded to indicate clearly that the results are not impressive, and it must be concluded that the cases of pernicious anæmia in which splenectomy is indicated must be few and far between. He referred to the use of transfusion, as perhaps the most valuable means of improving the patient's condition prior to the operation, and for counteracting the effects of shock and loss of blood so likely to develop in cases of splenectomy for splenomegalia. It is ideal to transfuse the patient both before and after operation. When only one donor is available the question may arise whether it is better to give the blood as a preliminary to or at the end of the operation. He believed that in such circumstances the ultimate result would as a rule be better if the transfusion was done at the completion of the operation. At the same time it is advisable to have the vein exposed and the citrated blood ready at the beginning of the operation so that the transfusion may be given at a moment's notice should the patient's condition become serious.

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Dr R. A. Fleming said he had never seen any special reason for splenectomy in pernicious anæmia. The bone marrow is the chief seat of trouble in this type of anæmia, and the part played by the spleen is by no means proved. The only obvious fact is, that in pernicious anæmia one finds a leucopenia, but that does not prove that the spleen is a leucocyte destructor. I have lately had three successful cases of pernicious anæmia and they all still possess their spleens. One case I showed the other day at the local meeting of the British Medical Association. This man had had syphilitic infection as well as being the subject of pernicious anæmia. He was the only case of the three who had an enlarged spleen. An interesting point is, that after treating him with neo-kharsivan on the usual lines, his spleen rapidly diminished in size and his blood picture, except for a persistent leucopenia, became normal. The man looks extremely fit and all evidence of an early combined sclerosis of his spinal cord disappeared. Whether the improvement will last I cannot say.

I have had two puzzling cases lately, one an undoubted case of purpura hæmorrhagica. The patient, a girl of 18, developed an extremely virulent Vincent's angina besides having extensive hæmorrhages, both subcutaneous and from her mouth, stomach, and vagina. Once we got the Vincent's angina arrested we had to transfuse her, and it was only after trying every known remedy, except splenectomy, we managed to pull her round. This girl never had any marked diminution of blood-platelets, in fact we counted 400 per cmm. Her spleen was never enlarged, and her leucocytes were never diminished in number. Professor Wilkie has not made out a strong case for splenectomy in purpura.

I have a case of Gaucher's splenomegaly in a patient, aged 28, who has had the disease since he was 5 or 6 years old. His spleen is now at the level of the umbilicus and was when I saw him first, in 1921, nearly 2 inches below that level. He has an extremely cirrhotic liver and is deeply jaundiced with persistent bile in his urine. There is no familial history, and he is not an instance of acholuric jaundice. When I saw him first he had marked ascites. He has had four applications of radium, with benefit as regards the diminution in size of the spleen. He has a marked leucopenia and his leucocytes have never exceeded 4000 per cmm. while they have been as low as 1200. This patient went to work as a painter at the age of 14, and from time to time has carried on without apparently any great difficulty except for occasional attacks of severe abdominal pain which have brought him to hospital for advice and treatment. At present I have him again in my wards and he has had a very extensive perisplenitis and perihepatitis. I discussed the case with Sir Harold Stiles some time ago and he urged attempting splenectomy, but the huge size of the spleen and the

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extreme degree of hepatic cirrhosis made me hesitate, and the patient refused. Dr Woodburn Morison has suggested the use of deep X-rays and this is to be tried when the perisplenitis subsides. The patient has lived and worked intermittently under present conditions for over twenty years and I am not sure whether he should be treated surgically now or not.

Mr Wade said the difficulty we have in discussing this subject is that most of us have had very limited experience in dealing with these cases. I can remember four conditions for which I have done the operation of splenectomy. I have had to remove on several occasions the spleen for trauma, chiefly at Leith Hospital where a number of such cases came under my care. One especially interested one of my physician colleagues; the boy recovered, and, during his convalescence and after his recovery, his blood was repeatedly examined, and as far as I can remember little if any alteration was found in it as the result of the loss of this important organ. I have operated on three cases of splenic anæmia. For two of these I was indebted to Professor Gulland. What impressed me at the time of the operation was the presence of an infarct which accounted, in one at least, for the very rapid increase in size of the spleen that occurred just before operation. Another point that they all demonstrated was the astonishing and rapid improvement in the blood picture after the operation. I have also operated for Banti's disease, and in Egypt I saw and heard a great deal of the operative treatment of this. The value of splenectomy in Banti's disease was highly spoken of, and the favourable case for this was the one in which there was a leucopenia. The fourth condition for which I have operated and I have done two cases, is classified by Mr Wilkie under the unjustifiable group. They suffered from chronic malaria. I was fortunate enough in these cases to have the opinion of two of the foremost authorities in the treatment of malaria in the world, and fortified by their recommendation the operations were done and the patients recovered. The argument put before me was exactly that used by Mayo in justifying the removal of the spleen in chronic syphilis. The cases had had intensive, active anti-malarial treatment and had not responded. The malarial parasite had entrenched itself within the citadel of the spleen and could not be dislodged and the removal of the citadel was advocated. Mr Wilkie has put forward a claim for the removal of the spleen in certain cases of pernicious anæmia. The arguments in favour of this do not convince me, for, using a similar line of reasoning, I could put forward a claim for the removal of the prostate. About a year ago I saw in Professor Gulland's ward a man suffering from pernicious anæmia. He was critically ill and had complete retention of urine from prostatic hypertrophy. I took over the case and under a local anæsthetic

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drained the bladder. To our immense satisfaction—I may even say astonishment—he improved rapidly afterwards, and to-day appears to be in perfect health, and is reputed to have recovered from the pernicious anæmia he suffered from. Pernicious anæmia is, undoubtedly, a remarkable disease subject to astonishing variations. I am afraid, however, the surgeon must still acknowledge that the treatment of it is in the domain of the physician and that we have no certain surgical cure to offer in this disease.

Professor Gulland said, as regards splenic anæmia, I do not think there is any question in anyone's mind nowadays that the proper treatment is splenectomy, but it is a difficult matter to know at what stage to do the operation, because there is a previous stage to those three to which Mr Wilkie referred, in which you have a man with enlargement of the spleen and leucopenia, with no anæmia and in perfect health. That stage may go on for a long period—a matter of years—before the second stage comes on, with anæmia, tendency to hæmorrhage, etc. I think that difficulty whether to operate or not is especially marked in the case of some of the younger splenic anæmias. About four or five years ago I had a series of cases in my wards, about halfway between the splenic anæmia of children and the splenic anæmia of adults—boys in whom the spleen was enlarged—and these would have been favourable subjects for the removal of the spleen, but they all got better. Splenic anæmia is a disease in which there are remissions. The patient improves sometimes with drugs—sometimes with arsenic, sometimes with iron.

I have had the spleen removed from a large number of cases, both by surgeons present and by their predecessors, and I must confess that the mortality has not been quite so low as that cited in the more recent cases, and that perhaps has rather put me off operation. I found, when I looked into my cases, a mortality of 30 to 40 per cent. When you have a chronic disease, which may not seriously disturb the patient for many years, you are inclined to put off the operation. Theoretically, the proper method is operation, because it is practically certain that in this disease the seat of the process is in the spleen, and it should be done before the anæmic stage sets in.

With regard to Gaucher's and Egyptian splenomegally—both really in the same category—I am in substantial agreement with Professor Wilkie. I have seen a large number of cases of malaria with enlargement of the spleen and I have never seen one which refused to respond to a combination of quinine and arsenic, so that I have not thought of removal of the spleen in those cases. We know that an enormous amount of blood passes through the spleen. How comes it that the malarial parasite in the spleen should be so specially inaccessible to quinine? I cannot see that the difficulty is any greater in that than

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in any other disease. One must not always argue, "Here is an enlarged organ which is not necessary to life—let us have it out."

As regards acholuric jaundice, the familial cases often do quite well with splenectomy, though the amount of disturbance caused by the jaundice is trifling and the patients get used to it, but I am not of opinion that in the acquired cases splenectomy should always be done, because I have seen quite a number—more in older people—where the patients refused operation because they were getting on quite well without it. I think in these cases it is very much a question of whether the patient is sufficiently ill—whether there is sufficient recurring disturbance to make it worth while to remove the spleen.

I have never seen any reason for removing the spleen in pernicious anæmia, and nothing I have heard to-night has made me change my opinion. The Mayos' procedure of removing the spleen is based on an entirely erroneous conception of the real value of transfusion. Transfusion is an excellent procedure in pernicious anæmia for getting the patient round a corner—it does not cure the disease. That is to say, it does not in itself make the patient much better, but it gives him a chance to recover himself while getting over the period of excessive toxicity. There is little evidence that the spleen is such a great destroyer of red blood corpuscles in this disease. Were it so, it would be much more often enlarged than it is. I can count on the fingers of my two hands the cases of pernicious anæmia I have seen in which the spleen was really large. It is common enough to get a spleen you can touch.

These cases with the very large spleen are usually cases which are not going to do any good anyway. Another point is that in pernicious anæmia the spleen often comes and goes, and it is by no means always largest when the disease is at its worst. Sometimes in the chronic cases enlargement of the spleen does coincide with a bad period, but not by any means always. There is no evidence that one can see that the toxic process is in the spleen or that the removal of the spleen is going to help.

I would emphasise the point that pernicious anæmia is a disease which runs so unexpected a course that it is difficult to say whether any particular method of treatment has been responsible for improvement. The removal of the prostate, in Mr Wade's patient, seemed to produce improvement. I have seen the removal of the gall bladder, and the removal of a fibroid tumour from the uterus do good. I have seen the mere leaving of the patient alone do good. I have seen a patient who looked as if she were at death's door—R.B.C. 760,000, unconscious, incontinent, so that it did not seem worth while to transfuse. She was put on arsenic and hydrochloric acid at once, but she did not have that long enough to make any difference; yet within

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two or three days the incontinence had disappeared, she began to improve, and within three weeks the reds went up to two millions. She is now a reasonable being and getting on rapidly, without, you may say, any treatment at all. If you remove the spleen you make sure that the patient stays in bed and you make sure that he rests, and a great deal of the subsequent improvement is most likely due to this fact. Pernicious anæmia patients stand operation extraordinarily well. I have had them operated on for one thing and another, with hæmoglobin below 30 per cent., and they did perfectly well. I know no class of case which looks so bad and which will stand operation so well as pernicious anæmias.

I would lay down a very strong objection to the way in which Professor Wilkie speaks of the hopelessness of medical treatment in these cases. These cases are hopeful if you approach them in the proper way. The real difficulty is that you cannot get practitioners to look after them when they particularly need to be looked after. During the period of remission they need to be looked after as carefully as when they are ill, and the period of remission ought to be utilised for the treatment of septic foci, intestinal disturbance, etc. The patient is so delighted to be so much better that he gets away from his doctor and the doctor does not hunt him up.

There is no evidence that leukæmia is a disease of the spleen or that the spleen has anything but a secondary rôle to play. One knows that the spleen destroys white cells, and from that point of view, it is useful to retain it. In radiation you have a useful help, especially when the patient is going down. In the majority of leukæmias you get improvement by radiation—an improvement which may last for years, and it is a valuable help to know when the patient is going back—without actual blood count—by the fact that the spleen is beginning to enlarge. If you have removed the spleen you do not have that help. I can cap the figures which Professor Wilkie mentioned, of patients going on for $7\frac{1}{2}$ years after splenectomy. I have seen leukæmias live for 12 or 15 years without splenectomy.

Further, there is the case of the thrombocytopænic purpuras. There is no doubt that splenectomy is useful in these cases. I have never had a case where I have found it necessary to splenectomise the patient because they have always got better by other means.

I have a patient suffering from polycythæmia, who is carrying on a useful career as a blood-giver for transfusion. She is a "universal donor." I know of another similar case, and I think it would be exceedingly useful to find out if all these cases are universal donors.

Mr Struthers said—I am struck by the fact that all Professor Wilkie's figures are trans-Atlantic. I do not mean to disparage them on that account, but it is surely a matter for regret that we cannot have

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figures ourselves. He has had his small experience, I have had mine, all the other surgeons have had theirs. Why cannot we put them all together? It is a ground for criticism of our methods that we have not had a little more co-operation on a subject which must interest all of us.

Dr McNeil said—In regard to Gaucher's anæmia I know it is said that the results of splenectomy in this disease are satisfactory and are compared with those in splenic anæmia. But I am a little doubtful about the correctness of the diagnosis. I have a suspicion that some so-called cases of Gaucher's disease may be really cases of splenic anæmia, and, after all, the differentiation between these two kinds of case is not easy. In both there is enlargement of the spleen, in both there is diminution of leucocytes, and in both, at a later stage, enlargement of the liver. With regard to hæmolytic jaundice a paper was written by Meulengracht of Copenhagen, who had collected, in his own experience, about 50 cases of hæmolytic (or acholuric) jaundice, (or familial icterus), of which the great majority were familial cases, with a few isolated cases, and of these I think 14 were submitted to operation, with very successful results. There is no question, that in these familial cases, operative treatment, by excision of the spleen, is successful, but I am not sure whether Meulengracht's cases were chiefly in young children or in persons after puberty. I had a case of hæmolytic jaundice, in a child, whom I first saw at the age of four—a little girl, very anæmic and jaundiced, with bile in the urine, and therefore, strictly speaking, not conforming to these criteria of hæmolytic jaundice. But there had been anæmia and jaundice since the age of six months, with remissions of the anæmia. There were very septic teeth which were removed; she had, with regard to the fragility of red blood corpuscles, an increased response, and I want to come back to that point later, for it is said to be a very important matter in the diagnosis of hæmolytic jaundice. The patient left hospital and returned two years later, again very ill, with jaundice and anæmia, and again with bile in the urine. Her condition in hospital became rapidly worse. Her red cells dropped from over 4 million to a little over 1 million. It was finally decided to operate. The operation was carried out, with a simultaneous transfusion of blood. All went well for a few days, but she died suddenly on the tenth day. At post mortem the liver and gall bladder were healthy. The pancreas was fibrosed and the spleen showed the picture of chronic fibrosis. It is difficult to be sure of the diagnosis in this case. I wish now to return to that question of the increased fragility of the red cells as a matter of great importance. As a matter of fact, Meulengracht does not attach great importance to this, and he cites cases of hæmolytic jaundice with no increased fragility of red cells.

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With regard to purpura hæmorrhagica, I do not think we can get away from the published results of great improvement after splenectomy in a definite type of case—the chronic relapsing case. No one advises excision of the spleen until years have elapsed and the condition is recurring. I think the majority of these cases occur in fairly young children. Dr George Sutherland has written a paper on that subject, and he describes the results of splenectomy in two cases. Professor Gulland raised the matter of blood platelets, the pathological significance of which is so obscure. . . . In Dr George Sutherland's cases he shows the extraordinarily rapid rise of the blood pressure after splenectomy. I do not think one can but be convinced that splenectomy played a very definite part in the cure of these cases. But with these he includes a third case—the worst of the series—a girl aged 13, who came into hospital, and while he was considering the question of operation she began to show improvement, continued to improve, and left hospital with a normal blood, and after many months still remained perfectly well, so that there is always the chance of spontaneous recovery in these cases of purpura. I think it is only in the chronic unrelieved cases that one would recommend splenectomy.

Von Jaksch's disease, as Professor Wilkie pointed out, is in some quarters not regarded as a disease at all but just a variety of secondary anæmia. But there are still many good authorities who take the old view. It is badly called von Jaksch's disease—it would be much better called pseudo-leukæmia of infants. It has a definite age incidence, for it occurs only in young children, between six months and three or four years, and there is great enlargement of the spleen, with definite increase of leucocytes, and I think the significance of the leucocytosis is the presence in the blood of a definite number of immature polymorphs. Now this disease, which is much more common than purpura, is by no means so benign as Professor Wilkie indicated. It has a fairly high mortality, and if it can be shown that splenectomy is a definite remedy, that would be a great advance in our treatment of this condition.

Dr Goodall said—Twenty-five years ago Noël Paton, Gulland, and I, both experimentally and in the blood diseases, not only described but made drawings of phagocytic cells in the spleen, hæmolymp glands, and marrow. What we did not discover was Aschoff's phrase, "reticulo-endothelial system," and thereby we missed fame. In the course of our animal experiments, one thing was made obvious, that if we excise the spleen, and then give a hæmolytic agent, it simply means that we get greater quantities of iron deposit in the other parts of the reticular system. In connection with this work, John Tait and his co-workers have done great service in showing the rapid taking up of ink and other particles by endothelial cells. The idea of a wide

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stimulation of these cells is, I think, a myth. They are merely doing their job when foreign particles or damaged blood cells are brought to them.

I think Professor Wilkie hardly did justice to the work of Barcroft in regard to the function of the spleen as a reserve store of blood corpuscles. It has been shown that when an animal is poisoned by carbon monoxide, the blood within the spleen takes up less carbon monoxide than the blood in general circulation, and there is a lag of something like half an hour, after the other corpuscles have been saturated before the splenic blood takes it up. It has further been shown that when the blood lacks oxygen or there is an active demand for oxygen, that acts as a stimulant to the muscle of the spleen which then contracts, and those reserve corpuscles are thrown into the circulation. I think that has a bearing on the question of splenectomy in pernicious anæmia—we may be depriving the patient of a useful reserve.

I venture to suggest that to his list of infective diseases Professor Wilkie might add kala-azar. Cases formerly thought to be malaria are now known to be due to that disease. I would like to refer to Mr Wade's successful splenectomies in malaria. He would have got equally good results if he had sent these patients home. There are ex-service men still trying to convince the Ministry of Pensions that they have malaria, but for years past not one of them has been able to show an enlarged spleen.

Several cases of splenic anæmia have been referred to, and I would like to mention one more. Dr Bowie and I had an interesting experience last August, when we attended a gentleman, 79 years of age, who died of splenic anæmia. He had had it as long as he could remember and it had interfered very little with his life, because in his young days he was a noted rugby player and known to opposing teams as the "yellow peril." In pernicious anæmia I think the hæmolysis is largely due to the increased size of the corpuscles and their size makes the hæmolytic process slow and conspicuous. Results of treatment are very difficult to assess. When a case begins to have a remission, not even splenectomy is likely to stop it.

Professor Russell said—The subject before us to-night has been fully gone into; and I am sure you have all appreciated the beautiful communication Professor Wilkie has made to us. His lucid and clear account of modern knowledge with regard to the spleen was, I think, extraordinarily well done; and with regard to his handling of the various diseases to which he referred and in which surgery may at times be useful, he showed a marvellously true judicial spirit. I do not think that there is very much difference of opinion between him and the various physicians who have contributed to the discussion.

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Mr Struthers made a remark about the want of co-ordination. If you will allow me to say so, my aim, so long as I have been chairman of this Society, has been to endeavour to gather up all the knowledge in Edinburgh of various conditions. I have not always been successful in getting all the Edinburgh knowledge and experience. The profession has had a very large experience, and has got more knowledge than sometimes comes out at these discussions. I think nothing would be more useful than this, that members of the Society, when a discussion is intimated, would come prepared to give their actual experience of the methods being discussed, so that they could be recorded in the transactions of the Society. To-night we have had an example of what can be done, and even to-night we have only had a fraction of what must be the surgical and medical experience of the maladies which Professor Wilkie has so ably dealt with.

Professor Wilkie said in reply—Mr Graham referred to the question of operative transfusion in these cases of splenectomy, and I think this is a question which holds good for a great many other diseases—whether it is better to give transfusion before operation, after operation, or both before and after. It depends a good deal on the method you are employing in giving the transfusion. In giving it by the citrate method there is no reason why one should not give part before and part after.

Dr Fleming mentioned certain cases which he had under treatment. The point that interested me chiefly about his cases was the fact that he proposed that his painter case, with the very large spleen, very cirrhotic liver and ascites, might possibly come to the surgical side, and his purpura case he proposed to keep on the medical side. I should say to Dr Fleming, We would welcome his purpura but he can keep his painter.

Mr Wade's experience with malaria is not by any means unique. One of our own graduates, Dr Smith in Penang, has carried out a large number of splenectomies for malaria and has recorded a considerable number of good results; but when one reads about the subject, particularly in the Italian literature—malaria being more or less endemic in Italy—one finds that these writers have definitely come to the conclusion that it is not necessary to remove the spleen in the chronic cases. If the parasite is dislodged from the spleen by X-rays it can be caught by quinine and destroyed.

With what Professor Gulland said, I think one must be almost altogether in agreement. When I spoke of the hopelessness of medical treatment of pernicious anæmia and leukæmia, I did not mean to say that a patient goes steadily downhill under medical treatment, but it would be difficult for a physician to point to a case of pernicious anæmia or splenomegalic leukæmia which had been definitely cured,

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and there was a hope that surgery might help. It is quite obvious that, in these two diseases, surgery has had extremely limited success.

I am in hearty agreement with Mr Struthers' remarks. It was a real pain to me to think that one had to go to America to get really reliable statistics about these conditions, and I felt somewhat ashamed that I could not, from our own school, get any series of statistics in regard to the surgical treatment of splenic disease. I think it is a reproach to us, who have a school with such an extraordinary wealth of material, that we cannot provide such figures ourselves.

Dr M'Neil referred to the fragility test in hæmolytic jaundice. One has had it frequently carried out, and the majority of those who write on the subject lay considerable stress upon this test. It would be an interesting subject for someone to take up and work at in this school—the real value of the fragility test in various conditions—not only in hæmolytic jaundice.

So much stress has been laid on the significance of blood platelets in purpura—sometimes on their total absence, sometimes on their great reduction, that it is interesting to note that in that most distressing condition, of post-operative thrombosis, Dr Evans of Liverpool has found that after operation there is always an increase of blood platelets. I think this is another question which would be a good subject for study.

Dr Goodall drew attention to the valuable work of Barcroft. I am quite cognisant of the value of Dr Barcroft's very striking demonstrations with dogs, in which, during exercise, more blood is suddenly required, and the spleen, previously exposed on the surface, is seen to contract and give out more blood.

I ventured upon this somewhat difficult subject, not because I could contribute anything new, but because I wished to learn something about it, and I thought a discussion might stimulate more surgery in these conditions than has been carried out so far. There is no question that we are not treating cases surgically that elsewhere are being treated by operation, with benefit, at the present time, and therefore, I hoped it would lead to what Mr Struthers has so very concisely described, to more co-ordinated work in our school than has previously been done.

CLINICAL MEETING *

EMERITUS PROFESSOR WILLIAM RUSSELL in the Chair.

Mr Hamilton demonstrated, for *Mr Dott*, a very unusual form of **Hydrocephalus**, in which the dilatation is limited to the left lateral ventricle. The cause of the condition was an old ependymitis affecting the lining of the left lateral ventricle, and resulting in blockage of the foramen of Monro. Operative treatment was carried out and the septum lucidum was removed, thereby establishing a communication between the two lateral ventricles. In this way the patency of the cerebro-spinal fluid system was restored. The operation scar is situated just below the left parietal eminence, and cerebral pulsation is visible there. The opening in the skull has a diameter of 2 inches. Prior to operation the child had a hemiparesis affecting the right side of the face and the right arm, and a right homonymous hemianopia. The hemiparesis has cleared up, but the hemianopia persists. Since the operation the child's head has diminished 4 cm. in circumference. Ventriculograms were shown which demonstrated the enormous dilatation of the left lateral ventricle, the oxygen having failed to pass into any other part of the ventricular system. At operation the septum lucidum was found to be very vascular, several large vessels having to be occluded by means of Cushing's wire clips. Subsequent X-rays showed that the remains of the septum had returned to its normal position, as the mid-line position of the clips showed. A picture (semi-diagrammatic) of the appearance of the left lateral ventricle at time of operation was shown, and also a diagram demonstrating the route of access through the ventricle.

Dr Robert A. Fleming (1) showed a girl, aged 17, who was admitted to his Ward suffering from very severe **purpura hæmorrhagica** on 16th November 1926. She was discharged, apparently cured, on 25th March 1927. On admission extensive hæmorrhages affected the face, trunk, and limbs. There was marked subconjunctival hæmorrhage and much submucous hæmorrhage inside the mouth. There was also bleeding from her mouth, bladder, bowel and vagina. She complained of considerable abdominal pain, making one think of a possible Henoch's purpura. For the first two weeks she had pyrexia, always more marked at night. The curious features of the case were a normal number of blood-plates, a normal blood-calcium content, and no prolongation time as regards blood coagulation. The spleen was not enlarged. The patient developed a severe attack of Vincent's angina and as a result lost the greater part of her soft palate notwithstanding prompt treatment.

* Held on Wednesday, 18th May 1927.

Clinical Meeting

Another curious fact in the progress of the case was that nearly all the skin over the hæmorrhages on the feet and hands and wherever there was any pressure ulcerated and healed very slowly.

The usual remedies were all tried including horse serum, calcium lactate and suprarenal extract, but it was only when we combined calcium lactate with parathyroid that the patient began to improve. It was difficult to make up one's mind whether splenectomy should or should not be carried out. There had been before this present attack no previous history of any hæmorrhages and no history of rheumatism. Apparently the severe attack had been preceded by a few purpuric spots which had disappeared with no special treatment.

(2) J. B., male, aged 57, was discovered accidentally to be a case of **Paralysis of the left half of the Diaphragm**. The patient was admitted suffering from bronchitis, and it was only when his chest was X-rayed in order to make sure that there was no alteration in his cardio-vascular shadow that Dr Woodburn Morison drew my attention to the paralysis. The radiograms show that there is no hernia of the stomach through the left half of the diaphragm, as the sharp outline of the paralysed diaphragm can be distinctly seen. Dr Woodburn Morison pointed out, also, that it was impossible to squeeze any of the barium meal through the cardiac orifice into the cesophagus. The cause of the paralysis appears to be a calcareous gland involving the left phrenic nerve. The presence of such glands is seen in the radiogram of the chest. The remarkable fact is that the symptoms and signs of the condition are so slight, especially the symptoms. It is true that the expansion of the left base is deficient as compared with the right, and that the percussion note is suggestive over the area of the cardiac end of the stomach, but there is very little evidence of recession of the left hypochondriac region on full inspiration as compared with the right. There is no undue dyspnoea such as one would have expected. I have had a similar unsuspected case some time ago first demonstrated to me by Dr Woodburn Morison, and the comparative absence of symptoms and signs was similar.

Dr W. T. Ritchie showed—(1) a case of **Lactescent Ascites** in a labourer, aged 67, who was under the care of Mr Lees a year ago for syphilitic sores on the face, but was otherwise in good health until the 19th March, when painless swelling of the abdomen began. Five days later, the lower limbs became dropsical and two days thereafter he was admitted to hospital.

The great enlargement of the abdomen is due to the collection of ascitic fluid. Paracentesis of the abdomen has been performed six times since the 5th April: the total quantity of fluid which has been withdrawn is 1946 oz. No enlargement of the liver can be determined, even after a paracentesis. The ascitic fluid has a pale

DO THE PHARMACOPŒAL PREPARATIONS OF
ERGOT CONTAIN ANY ACTIVE PRINCIPLES?*

By PROF. A. J. CLARK, F.R.C.P.

By invitation.

I MUST start by confessing that I have no new discoveries to
lay before this meeting and that my paper is really an effort at

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SESSION LXXXVI.—1926-1927

in the light of your clinical experience of the drug.

The very powerful and curious toxic actions of ergot have been known only too well since prehistoric times, since epidemics due to the eating of ergotised rye have repeatedly produced widespread poisoning in Europe. The earliest recorded epidemic was in the ninth century and several epidemics occurred as late as the last half of the nineteenth century. Before the advent of steam transport the inhabitants of large districts after bad summers frequently had the choice of either eating ergotised rye or else starving, and hence epidemics of ergotism frequently killed or maimed large numbers.

Two distinct types of epidemics occurred, namely (1) the

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Clinical Meeting

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By invitation.

I MUST start by confessing that I have no new discoveries to lay before this meeting and that my paper is really an effort at propaganda, for I desire to enlist your help in clearing up a remarkably unsatisfactory situation. The position is that the laboratory workers, that is to say, the chemists and pharmacologists, agree that ergot contains certain specific active alkaloids, and they believe that these are the substances upon which its therapeutic value in obstetrics depends, but they also agree that the preparations of ergot described in the British Pharmacopœia cannot contain more than traces of these active alkaloids, and hence they conclude that these said preparations must be almost completely inert.

On the other hand, these B.P. preparations have been used for at least thirty years without complaint by clinicians. Since a new pharmacopœia is likely to be prepared in the near future, it is obviously of public interest that this uncertainty should be settled. This can only be done by co-operation between laboratory and clinical workers. I propose to-night to set before you the evidence in favour of the beliefs held by the laboratory workers, and I trust that you will criticise these in the light of your clinical experience of the drug.

The very powerful and curious toxic actions of ergot have been known only too well since prehistoric times, since epidemics due to the eating of ergotised rye have repeatedly produced widespread poisoning in Europe. The earliest recorded epidemic was in the ninth century and several epidemics occurred as late as the last half of the nineteenth century. Before the advent of steam transport the inhabitants of large districts after bad summers frequently had the choice of either eating ergotised rye or else starving, and hence epidemics of ergotism frequently killed or maimed large numbers.

Two distinct types of epidemics occurred, namely (1) the

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convulsive type in which the initial symptoms were diarrhoea and vomiting, and muscular spasms resembling tetany; these developed to epileptiform convulsions with tonic contractions of limbs; (2) the gangrenous type, which commenced with diarrhoea and vomiting followed by gangrene of the extremities, the fingers and ears being first affected. Frequently whole limbs were lost, and there are accounts of individuals reduced to a trunk and head. Usually the symptoms in all the cases of any particular epidemic conformed to one or other of these two types. The occurrence of two distinct types of poisoning indicates that there must be several active principles in ergot and that the composition of the drug must vary from year to year.

Abortion occurred frequently in epidemics of ergotism, and the oxytoxic action of ergot was recognised very early. In 1582, Adam Lonicer of Frankfurt mentioned the use of ergot in hastening labour. In the seventeenth century it was used extensively for the purpose of criminal abortion, and in consequence its employment was forbidden by many authorities. In the eighteenth century, however, it was reintroduced as a therapeutic agent in obstetrics.

The nature of the action of ergot was established very early, for instance, Buchheim, in 1859, stated: "Ergot is used very frequently to stimulate the contractions of the uterus when there is prolonged weakness of the pains. Violent and prolonged pains usually commence ten to twenty minutes after administration of the drug, and delivery soon follows. This can only happen in safety when there is no mechanical obstruction, due to such causes as contracted pelvis, abnormal position, etc., and when the cervix is fully dilated, although the pains are not strong enough to produce delivery. In other conditions the violent contractions can easily produce injury to the uterus, and therefore many doctors dislike the use of the drug. . . . The activity of ergot is very unequal, from various causes. Ergot from very wet places is inactive. Preparations lose activity on keeping and no method of producing a stable preparation has been discovered. It is best to give the drug as powder 10 to 20 grains every fifteen to twenty minutes until the desired action occurs." This is a remarkably clear summary of the chief actions of the drug, and there is little to be added to this statement to-day. Ergot is therefore a drug with a definite therapeutic action which has long been recognised.

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Chemistry of Ergot.—A great deal of work was devoted to isolation of the active principles of ergot last century. The outstanding discoveries were as follows:—

In 1874, Buchheim suggested that the action of ergot was due to the "putrid and septic" substances it contained, and, in 1875, Tanret isolated a pure crystalline alkaloid ergotinin. In 1884, Kobert however showed that ergotinin was pharmacologically inert. In 1906, Barger and Carr¹ isolated the alkaloid ergotoxin. Barger and Dale² proved that this ergotoxin produced all the chief pharmacological actions of ergot, which were rise of blood pressure, contraction of the uterus, and paralysis of the sympathetic.

Kraft identified ergotoxin as the hydrate of Tanret's ergotinin, and the formula $C_{33}H_{41}O_6N_5$ was finally adopted.

Further research by Barger, Dale, and others showed that in addition to its specific alkaloid, ergot contained a series of non-specific amines, substances which can be produced by the putrefactive breakdown of most proteins. The most important of these amines were (i) tyramin (*p*-hydroxy-phenyl ethyl amine), derived from the amino-acid tyrosin; and (ii) histamin; (β -amino-azolyethylamin) derived from the amino-acid histidin.

Other substances were—agmatin, similarly derived from arginin, cholin, acetylcholin, methylamin, ethylamin, etc., and numerous other substances, one of which, namely ergosterol, has suddenly acquired importance as the precursor or provitamin of vitamin D.

Finally, Stoll, in 1922, isolated a new specific alkaloid ergotamin ($C_{33}H_{35}N_5O_6$). This substance had apparently exactly the same pharmacological action as ergotoxin (Dale and Spiro).³ I am unaware of the relative amounts of these two alkaloids present in ergot.

For practical purposes, therefore, the active principles of ergot can be divided into (a) the specific alkaloids ergotoxin and ergotamin which occur only in ergot; and (b) a host of other non-specific substances, products of protein breakdown, etc.

Obviously the first question that arises is the relative importance of these two groups as regards the therapeutic use of ergot. Now the first obvious fact about ergot is that it produces its specific effects when given by mouth. This is evidenced both by the history of ergotism and everyday

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experience in therapeutics. This alone proves that most of the non-specific amines are of little importance as regards the therapeutic action of ergot. For example, in 1910, the writer⁴ investigated the action of tyramin on man and found that 15 mgrms. of tyramin produced a distinct rise of blood pressure when given hypodermically, but that 200 mgrms. by mouth produced only a doubtful action.

The action of tyramin by mouth is therefore only about one-tenth of its action when given subcutaneously, and from animal experiments one may conclude that its action by mouth is less than one-hundredth of its action when given intravenously.

Histamin is a very powerful pharmacological agent when given subcutaneously. Schenk⁵ found that 2 to 4 mgrms. of histamin in man given subcutaneously produced a violent reaction, namely, fall of blood pressure and violent headache and contraction of plain muscle.

Meakins and Harrington⁶ found in cats that 160 mgrms. histamin put into the stomach produced only a slight fall in blood pressure, although 25 mgrms. put into the duodenum produced a large fall of blood pressure.

Since, however, 0.5 mgrm. of histamin given intravenously to a cat produces a large fall of blood pressure, these results show that the drug loses more than 95 per cent. of its activity when given by mouth.

The explanation of this difference is that the liver can break down tyramin, and can store histamin.

Now the content of ergot in these principles is not great, as Barger and Dale⁷ found that there were only a few decigrams of tyramin per kilo of ergot.

Tests that I made with the usual ergot preparations upon the isolated uterus of the guinea-pig indicated a content of less than 1 in 10,000 histamin in ergot.

Now 30 minims (2 c.c.) of liquid extracts of ergot corresponds to 2 grams. of ergot powder, and therefore this dose will contain about 1 to 5 mgrms. tyramin and less than 1 mgrm. histamin.

Neither of these quantities is sufficient to produce any demonstrable action by mouth.

On the other hand, the specific alkaloids of ergot are present in quantities sufficient to produce a definite action when given by mouth, for ergot contains from 1 to 2 grams. per kilo of specific alkaloids, and hence, 2 c.c. would contain about 2 mgrms. specific alkaloids.

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This corresponds to the therapeutic dose by mouth of the pure alkaloids. Therefore the specific alkaloids of ergot must be considered the only constituents of any therapeutic importance when the drug is given by mouth. When ergot is injected subcutaneously the histamin present may produce an action, but histamin is a highly dangerous drug on account of its powerful action in producing shock. Furthermore, if it is desired to administer histamin or tyramin, it is easy to get them pure from other and cheaper sources than ergot, and hence there is no reason to retain ergot in the pharmacopœia, if all that is needed is a supply of these amines.

The Alkaloidal Content of Ergot Preparations of the British Pharmacopœia.—Ergotoxin was first isolated in 1906, and in 1907 Barger and Dale² made the following statement: "From the physical and chemical properties of ergotoxin already described, it will be clear that its occurrence in any considerable proportion in the official aqueous extract (*extractum ergotæ liquidum*) is not probable. Small traces of an alkaloid, soluble in chloroform and giving the physiological reactions of ergotoxin, can be obtained from most specimens of the extract. Since ergot always contains a considerable quantity of di-acid potassium phosphate, these traces of ergotoxin are probably dissolved as the phosphate, which, in the presence of salts, is very slightly but distinctly soluble."

This was written twenty years ago, and all subsequent investigations have confirmed this conclusion.

Carr and Dale, in 1913 (*Brit. Pharm. Year Book*, 1913, p. 5), summarised the properties of the official preparations of ergot as follows:—

"Ergotoxin has properties very unusual in an alkaloid. Its salts possess very little true solubility in water, and not much in dry alcohol. They are more soluble in mixtures of alcohol and water than in either solvent alone. In pure water they form colloidal solutions, from which they are readily thrown down by strongly ionised acids or their salts. In the presence of alkalies, such as ammonia or sod. carb. or hydrate, ergotoxin is unstable. . . . It will be clear from a consideration of these properties, that the ideal extract for obtaining the full proportion of ergotoxin from a given ergot, and for retaining it in solution, will be made with moderately dilute alcohol, acidified with a feebly dissociated acid, such as acetic, tartaric or phosphoric acid. We may note in passing that such an extract

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exists in the fluid extract of the United States Pharmacopœia, and the method of its preparation is understood to have been chosen as the result of a series of clinical trials. From the point of view of securing the presence of ergotoxin, it would be difficult, on the other hand, to find worse methods than those laid down for the preparation of the extracts of the B.P. The method for making the *extractum ergotæ* (ergotin) begins rationally indeed by extracting with 60 per cent. alcohol. In actual practice it is found that a certain amount of the ergotoxin which is obtained by this initial extraction is lost during the removal of the alcohol by concentration, and still more is thrown down when diluted hydrochloric acid is added. Such addition, as mentioned above, would precipitate ergotoxin even from pure solutions; and in this instance the process is facilitated by the absorbent action of the acidic resins which are thrown down. When these are filtered off the filtrate is practically free from ergotoxin.

"We have been able to detect no more than traces, even by the delicate physiological reaction in ergotin prepared by careful adhesion to the official formula, from ergot to first-rate activity."

This was written fourteen years ago and requires revision, for in the B.P. 1914 the method of preparation of solid extract of ergot was altered. None of the process can now be described as rational, for the extraction with alcohol has been abandoned and the first extraction is now performed with water.

The same criticism is true as regards the liquid extract of ergot. Carr and Dale say as regards this: "While the process for *extractum ergotæ* (ergotin) starts by extracting the ergotoxin, and gets rid of it at a later stage, that for the *extractum ergotæ liquidum* extracts only a small and variable proportion, ergotoxin salts, as pointed out above, being very slightly soluble in water. The presence in ergot itself of feebly dissociated organic acids, and the formation of such acids by the fermentative changes which occur during the preparation of the extract, assist in varying degree the solution of traces of ergotoxin, but this effect is to some extent counteracted by the boiling down of the extract, especially if this is performed with free access of air; and

"In any case the liquid extract would be expected to contain only a very small and variable fraction of the ergo-

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toxin in the ergot. This expectation is entirely confirmed by the physiological test, according to which even freshly-prepared liquid extracts from highly active ergot contain at best little, and often hardly any, ergotoxin."

The only change since these words were written is that the B.P. 1914 substituted water extraction for alcoholic extraction in the first process of the preparation of solid extract of ergot, and therefore this now contains less active principle than formerly.

In 1923, Broom and the writer⁹ devised a method of ergot standardisation that permitted the detection of very small concentrations of the specific alkaloids. This method depended on the fact that the specific alkaloids abolish the sensitivity of the rabbit's uterus to adrenalin. Messrs The British Drug Houses kindly prepared for me all the B.P. preparations of ergot. The activity of the original drug was estimated by preparing a liquid extract according to the method of the United States Pharmacopœia which is a rational method based on extraction with 60 per cent. acid alcohol. The activity of the United States Pharmacopœia liquid extract was taken as 100, and the B.P. preparations gave the following values (Clark and Broom)¹⁰ :—

| | | | | |
|------------------------------------|---|---|---|-------|
| Liquid extract of ergot | . | . | . | < 3 |
| Ammoniated tincture of ergot, B.P. | . | . | . | 10 |
| Infusion of ergot, B.P. | . | . | . | < 0.6 |
| Solid extract of ergot | . | . | . | 30 |

With regard to these figures, it must be remembered that from 1 kg. of ergot is obtained—

| | | | | |
|---------------------|---|---|---|----------------------|
| Liquid extract | . | . | . | 1 litre |
| Ammoniated tincture | . | . | . | 4 " |
| Solid extract | . | . | . | less than 100 grams. |
| Infusion | . | . | . | 20 litres |

The ammoniated tincture, therefore, contains a considerable fraction of the possible yield of alkaloids, the liquid extract and infusion and solid extract 3 per cent. or less.

The remaining pharmacological preparation of ergot is the injection, and this is made from the solid extract and therefore requires no discussion. These results, of course, confirm exactly the conclusions of Barger, Dale and Carr.

The methods laid down in the B.P. for the production of ergot preparations are such that if adhered to strictly nearly the whole of the specific alkaloids are lost.

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The foreign pharmacopœias with which I am acquainted, namely, the Dutch, American and German, all prescribe rational methods based on extraction with faintly acid alcohol. Ergot when macerated becomes faintly acid and therefore extraction with alcohol alone is a fairly efficacious method.

It is interesting to note that the B. P. of 1885 contained a tincture of ergot based on the extraction of ergot with alcohol. This, however, was dropped in 1898.

Since the chemical knowledge of good pharmacists and of manufacturing chemists is in advance of the pharmacopœial standards, many active preparations of ergot are available.

Conclusions. — The chemists and pharmacologists have reached perfectly definite conclusions, namely :

- (1) The therapeutic action of ergot when given by mouth is due to its content of specific alkaloids.
- (2) The B.P. preparations of ergot contain little or none of these alkaloids.

The obvious conclusion is that ergot as given at present in this country is a completely useless drug and depends on the reputation it acquired here prior to 1885, and on the effects produced by it in foreign countries where the preparations are active.

Ergot is, of course, a highly important drug since it is the only drug that can be given by mouth which will cause uterine contraction, and hence is in general use by midwives. Moreover, ergot produces a much more prolonged effect than does pituitary extract.

Sir Nestor Tirard¹¹ has defended the present preparations of ergot on the grounds that no one has complained of them !

This is the mystery I desire to have solved. Why are the clinical workers apparently completely satisfied with preparations which appear to laboratory workers to be inert ?

REFERENCES.—¹ Barger and Carr, *Journ. of Chem. Soc.*, 1907, vol. xci., p. 337. ² Barger and Dale, *Biochem. Journ.*, 1907, vol. ii., p. 240. ³ Dale and Spiro, *Arch. f. Exp. Path. v. Pharm.*, 1922, vol. xcv., p. 337. ⁴ Clark, *Biochem. Journ.*, 1910, vol. v., p. 236. ⁵ Schenk, *Arch. f. Exp. Path. v. Pharm.*, 1921, vol. lxxxix., p. 332. ⁶ Meakins and Harrington, *Journ. of Pharm. and Exp. Ther.*, 1922, vol. xx., p. 45. ⁷ Barger and Dale, *Arch. f. Exp. Path. v. Pharm.*, 1909, vol. lxi. p. 113. ⁸ Carr and Dale, *Year Book of Pharmacy*, 1913, p. 5. ⁹ Broom and Clark, *Journ. of Pharm. and Exp. Ther.*, 1923, vol. xxii., p. 59. ¹⁰ Clark and Broom, *Year Book of Pharmacy*, 1923, p. 621. ¹¹ Tirard, *Brit. Med. Journ.*, 1922, vol. ii., p. 1173.

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DISCUSSION.

Professor Barger, commenting on Professor Clark's criticism of the British Pharmacopœia, considered it quite in keeping with the traditional conservatism of this publication that it should refer to ergot, a drug which midwives might use, and should omit pituitary, the preparation on which physicians mainly relied.

The first reference to the medicinal use of ergot is usually stated to be that by R. J. Camerarius (1688; "*singulare præsidium ad compescendum lochiorum fluxum*"), but the speaker, who had formerly paid a good deal of attention to the earlier literature on ergot, had found a statement in the 1582 edition of the herbal (Kreuterbuch) of Adamus Lonicerus (cap. ccc., vol. lxx., p. 285) to the effect that doses of three ergot grains repeated several times are very efficient in bringing on labour pains. This statement occurs also in the 1593 edition, but not in those of 1560, 1564 and 1573. The entry of ergot into official medicine dates from a brief reference by Parmentier in 1774 and more particularly from a detailed paper by Desgranges, a Lyons obstetrician, in 1777. Papers by Stearns (1808) and Prescott (1815), both in New England, may also be noted, as having given an impulse to its adoption by British physicians (e.g., Adam Neale, *Researches respecting the Natural History, Chemical Analysis and Medical Virtues of the Spur, or Ergot of Rye*, London, 1828).

The speaker attributed the absence of epidemic ergotism in Britain to the fact that rye was hardly cultivated in this country. The only clear British case was a sporadic one due to wheat; a mother and five children near Bury St Edmunds lost one or two feet or legs (*Phil. Trans.*, 1762, vol. lii., p. 530, letter by the Rev. J. Bones to G. Baker, F.R.S.). A fresh case was described by Colles (*Quart. Journ. Med. Sci.*, 1847, vol. iv., p. 243).

The speaker did not agree with Professor Clark's inference that the two types of ergotism are due to two different active principles. He quite agreed with the view that the non-specific amines of ergot were of little clinical importance, if any, although during the war considerable attempts had been made in Germany to use these amines. The specific action, both in ergotism and in obstetrics, was due to the closely related alkaloids, ergotoxin and ergotamin. The alleged activity of ergotinin was probably due to hydrolysis to ergotoxin, or to the use of "amorphous ergotinin" containing ergotoxin. This was particularly the case in preparations like ergotinin citrate. Cornutin was also a less pure form of ergotoxin.

A question at present occupying the speaker experimentally was the chemical relationship of ergotoxin $C_{35}H_4O_6N_5$ to Stoll's ergotamin $C_{23}H_{25}O_5N_5$. Pharmacologically these two alkaloids were identical.

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Chemically they appeared to differ by the elements of a molecule of alcohol, but neither Stoll nor the speaker have been able to effect an inter-conversion. Many active samples of ergot, rich in ergotoxin, contained at most traces of ergotamin; hence the very high price of the latter alkaloid, which could only be obtained from certain varieties of the drug.

The chemistry and the pharmacology of the active principles of ergot appear in the main to have been settled. It is for the clinicians to investigate which ergot preparations, if any, are preferable to pituitary.

Dr Orr said a very illuminating description of the constitution of ergot had been given and the difficulties which pharmacologists had in respect of the therapeutic use of the drug had been clearly shown. One could accept without any doubt that the pharmacological facts were correct and that ergot constitution had been determined.

With regard to Professor Clark's remark that there were two types of ergotism—a convulsive type with convulsive symptoms affecting the limbs which occurred in certain cases, and also the other type that led to gangrenous conditions in the extremities—he agreed. Both conditions could be explained on the hypothesis that the actions were traceable to the same cause. The spinal convulsive effects and the peripheral effects were both due to the action of the ergot on the vessels which supplied the spinal cord, producing spinal anæmia which resulted in motor and sensory irritation. The other type, producing gangrenous changes, was determined by the vascular constriction effecting the vessels of the limbs. For example, in a person engaged in heavy work, whose spinal centres were much exercised, there was a tendency for spinal effects to be produced; whereas, in other conditions, with peripheral manifestations, the gangrenous symptoms were produced, and the same alkaloid was able to produce these two apparently diverse sets of symptoms.

With regard to the discrepancy found by pharmacologists between the inaction of the drug in solution and its use by clinicians, long ago he ceased to have any faith in the liquid preparations of ergot, ceased to use it and employed other preparations in the market at the time. There were two preparations—ergotinin and ergotinin citrate. Ergotinin was of no use, but ergotinin citrate was of value. It was given in doses of $\frac{1}{50}$ th gr. Ergotinin and ergotinin citrate produced different effects. Whether the ergotinin citrate was capable of being converted into ergotinin hydrate, he did not know, but Professor Barger suggested that if ergotinin was converted into a hydrate then it would operate in the manner of ergotoxin. It was possible that ergotinin citrate was convertible into ergotinin hydrate in the blood stream, and if so, the activity of ergotinin citrate could be explained on this hypothesis.

Another preparation on the market was cornutin, which was regarded as being a mixture of the active principles of ergot. It was given in

Pharmacopœal Preparations of Ergot

doses of $\frac{1}{40}$ th gr. It was a very useful, reliable and efficient preparation. In his experience it could be relied upon to produce typical ergot effects in hæmorrhages from the uterus. It readily checked not only hæmorrhages after labour, but also hæmorrhages in connection with menorrhagia. When cornutin became unobtainable he did not go back again to liquid ergot, but went on to use quinine and found that acid quinine hydrochloride gave admirably all the actions which dry preparations of ergot had given. There were several other preparations. Thus, lodal was not bad, but it was not comparable to acid quinine hydrochloride. Many of these liquid ergot preparations then were of no value; but with certain substitutes, such as cornutin, which contained ergotoxin, the results produced were the same as those attributed to ergot.

Dr Haig Ferguson said that the speakers had proved what many of them had felt for years—that the Pharmacopœia preparations of ergot were practically useless. He himself had not used the liquid extract of ergot for a long time. It was true that ergot was the only drug which the midwives were allowed to use after labour, and certainly after what had been explained to them to-night it was a singularly innocuous one as hitherto administered. It was to be hoped that in the new Pharmacopœia a preparation of ergot would be produced which would enable the profession to get the full benefits of this useful and powerful drug.

Dr Ferguson agreed with Dr Orr as regards the value of cornutin, which he had used when it was procurable with distinct benefit. He also had found ergotin citrate satisfactory.

There could be little doubt but that the preparations of ergot as manufactured in America contained more of the essential principles of the drug than at any rate the majority of the British productions. In his experience there could be no doubt that quinine had a very valuable effect on the uterus especially when given as a soluble salt. He constantly used it in practice with, he thought, great advantage. In this connection he would like to draw attention to the great benefit of the administration of ordinary sugar internally in helping to cause contraction of a feeble uterus. He had used it several times in cases of secondary inertia in the second stage, and in several cases of threatened postpartum hæmorrhage. He would like to know Professor Clark's views on the effect of sugar upon unstriated muscle. Dr James Ritchie first drew Dr Ferguson's attention to it from a clinical point of view. It should be given in doses of one or two tablespoonfuls at a time, and it had the advantage of always being available. The late Dr George Gibson used to administer it in flabby conditions of the heart and found it often of great benefit.

Dr Somerville said that in general practice there was the acute use of ergot for, say, postpartum hæmorrhage; for this condition he now

Professor A. J. Clark

never used any pharmacopeial preparation because pituitary was much more satisfactory in every way. It was sad to think of the money wasted in the use of ergot in chronic cases such as menorrhagia. In National Health Insurance practice one was bound to use pharmacopeia preparations, and in the large percentage of failures one blamed the patient's idiosyncracies rather than the drugs. One would certainly not use them in future, and the speakers should be thanked for pointing out the uselessness of the B.P. preparations.

The President conveyed the thanks of the Society to Professor Clark and Professor Barger for their most interesting remarks. With regard to the last question, in which Professor Clark summarised the subject of his paper, namely—why was it that these futile preparations had been allowed to remain in the pharmacopeia without a complaint, he thought the answer was that either they had scarcely ever been used or doctors had not thought it worth while complaining of failures. For himself he had not used the pharmacopeial liquid extract of ergot in the last twenty years, but he had frequently used the solid extract and got good results by combining it with quinine and nux vomica. He now realised that most of the good must be due to the two latter components. He was in the habit also of using ergot by intramuscular injection, and with moderately satisfactory results. He was interested to hear that Professor Clark believed that the methods adopted by manufacturers for non-official preparations were calculated to produce a more active extract. Amongst preparations which he employed frequently were ernutin, "aseptic ergot," and secacornin which must be similar to the cornutin referred to by Dr Orr. Femergin was another preparation which he had used recently with fairly effective results. Pituitary extract, which had been mentioned in contrast to ergot, acted, in his experience, much more rapidly when injected intramuscularly than any of the ergot preparations, but its action was more transient, so that in any case of really serious postpartum hæmorrhage he would give both.

The President thought that the discussion had a very practical bearing. As an instance he stated that in 1926 thirteen Winchester quarts of pharmacopeia liquid extract of ergot had been used in the Royal Maternity Hospital. The cost of this was approximately £6, 10s., and presumably all that money had been thrown away so far as any benefit to the patients was concerned. In addition to that twelve dozen ampoules for hypodermic injection at 9s. a dozen, or thereby, had been used, though some result had presumably been obtained from them.

In conclusion he wished to say that if there was any way in which the Fellows of the Society as clinicians could assist Professor Clark in his researches with regard to the various preparations of ergot, he hoped Professor Clark would communicate with them, as they would be only

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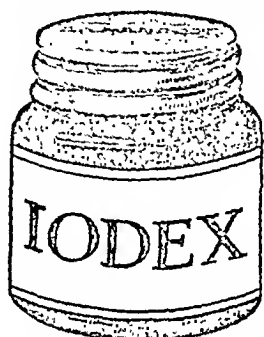
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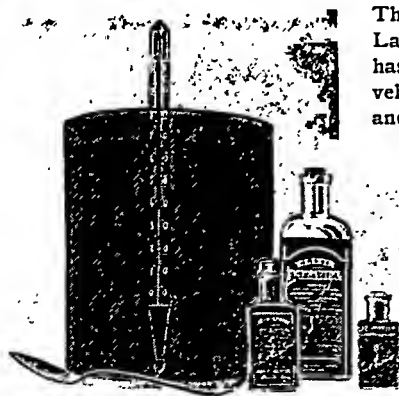
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of their contributions to chemical and laboratory research. This would include subsidies to workers whose present efforts lie in the direction likely to yield results of importance in the problem under consideration; and also to other workers to whom special and new lines of research will be suggested; also grants to those who contribute statistics, data, results of private experiment, research or observation. The powers possessed by the Trustees enable them to disburse moneys by way of bonus to any worker whose contribution is judged to be of exceptional, or indeed of any value. These powers include the option to close the Fund altogether by making a grant of the whole of the Capital remaining at any time to a worker whose contribution shall be judged by the Committee of Trustees, acting with the Scientific Committee, to have finally disposed of the present obscurity overlying the knowledge of the disease, and thus to give the medical profession "control" over the disease.

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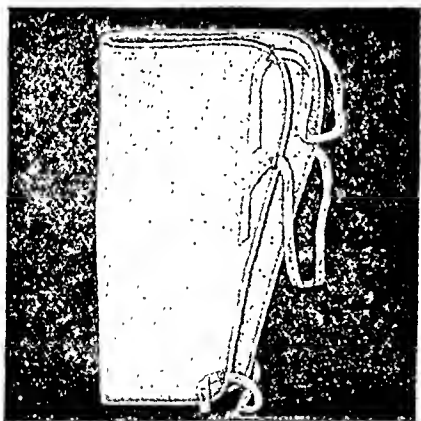
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Edinburgh Medical Journal

September 1927

THE EFFECTS OF VOLCANIC ACTION IN THE PRODUCTION OF EPIDEMIC DISEASES.

By JOHN D. COMRIE, M.A., B.Sc., M.D., F.R.C.P., Lecturer on Practice of Medicine in the School of Medicine of the Royal Colleges at Edinburgh.

DR JOHN PARKIN, a Fellow of the Royal College of Physicians at Edinburgh, who by his will founded the Parkin Prize in the year 1889, for essays upon certain subjects prescribed by him, lived from 1801 to 1886. The following essay deals with one of these subjects.*

The Nature of Volcanic Action.—The conceptions of physicists and geologists in regard to the nature of volcanic action have greatly changed since the time of Dr Parkin. The theories generally held with regard to the cause of volcanic action are different, much more is known in regard to the chemical and physical changes related to it, and the general connotation of what is embraced by the term volcanic action or vulcanicity, is now much wider. Eruptions, whether of the explosive type or partaking of the nature of a gradual injection of semi-fluid material, are regarded as a comparatively minor part of the movements and changes embraced in the term.

The earth movements with which vulcanicity is connected are in constant progress, although the more violent movements do not now occur as in an earlier period of the earth's history. Observation by means of sensitive instruments shows that the crust of the earth is in many places in a state of almost constant vibration, with every gradation between these fine tremors and the complex disturbances which are called earthquakes. These disturbances are specially noticeable in districts close to great geological faults. The eruptions of volcanoes are generally accompanied by disturbances of the ground in their neighbour-

* Awarded the Parkin Prize by the Royal College of Physicians, Edinburgh, 1927.

hood, although shocks often occur unaccompanied by any eruption. Recent examples of earthquakes were the San Francisco disaster of 1906, in which there was a measurable displacement on the surface, and the earthquake which destroyed the cities of Messina and Reggio in December 1908. In the latter case, the area affected was close to the concave side of a line of folding of the Alpine system and was attributable to a settling down of the depressed area, which now forms the Tyrrhenian Sea.

The greater movements of the earth's crust, which have been accompanied by welling out of lava on a grand scale, have been the chief determining factors in the formation of land and in the relation subsisting at the present time between land and water. Among these gradual examples of volcanic action may be mentioned the formation of the basalt plateau of the Snake River, extending for some 200,000 square miles, with a thickness of about 3000 feet; and the Deccan Plateau in Central India, which appears at one time to have covered over 400,000 square miles of the Indian Peninsula with a maximum thickness of 7000 feet near Bombay; and also the lost land in the North Atlantic, to which further reference will be made later, and of which only isolated stumps now project above the waters of the Atlantic.

Compared with these, the effects of actual explosions occurring in the eruption of volcanoes have been relatively localised and of comparatively little influence either in the formation of land surfaces or in effects upon the destinies of the human race. The products of vulcanicity may be erupted either in gaseous, liquid or solid forms, and vary greatly in different cases and at different stages in the activity of the same volcano.

With regard to gaseous materials, compounds of sulphur are very common, especially sulphur dioxide and sulphuretted hydrogen. Hydrochloric acid is also an important constituent which is frequently found in volcanic vapours and which is of considerable importance in the chemical changes it produces in the rocks, especially as regards their iron constituents. Carbon dioxide is commonly given off in large quantities during the later phases of the activity of the volcano. The most important gaseous constituent is, however, steam. This is produced in vast clouds during nearly all eruptions. It is important in regard to the effect on the human inhabitants of the surrounding

Volcanic Action in Epidemic Diseases

countries, because of the torrential rains which are found to accompany most sudden manifestations of volcanic activity. It is of still greater importance from the physical point of view, because it is now held to form the motive power of the explosive activity when this occurs. In some cases these torrential rains, by bringing down or falling upon accumulations of fine ash and dirt, have produced gigantic flows of mud which nothing could withstand. In this way, for example, Herculaneum was destroyed. In other cases floods have been produced, as, for example, in the eruption of Cotopaxi in 1877, when a great flood travelled for an immense distance at a rate of 20 miles an hour, devastating the surrounding country. As some heavy machinery from a cotton mill was carried 30 miles by the flood, the effects of such eruptions in past times, when their force was probably much greater, can be readily understood.

Steam is now regarded as the motive power of volcanic eruptions, and the following explanation given by Arrhenius is generally accepted by geologists as the true explanation. It may be observed that all volcanoes, active or extinct, are situated close to the sea or at all events close to large expanses of water which have at one time been sea. Thus, a ring of volcanoes surrounds the Pacific Ocean in the islands of Sumatra, Java, the Moluccas, the Philippine Islands, Formosa, Japan, Kamchatka, Alaska, and down the west coast of North and South America. Similarly, in regard to the Atlantic, the beds of basalt are found in the Arctic Islands, Iceland, the Faroes, the North Hebrides, the north-east of Ireland, the west coast of France and the west coast of Africa, while most of the oceanic islands of the Eastern Atlantic are wholly volcanic in origin. There is also an important series of extinct volcanoes along the great Rift Valley, stretching from the north of Palestine to Kilimanjaro in North Africa. Numerous volcanoes are also associated with the Mediterranean.

According to Arrhenius, heated magma lies everywhere at a certain depth below the sea floor, through which water penetrates by capillarity. Since this magma has a temperature much above 325°C ., the critical temperature of water, the water is present in gaseous form. The sea floor with its capillary passages acts like a semi-permeable membrane with pores sufficiently large to admit water, but not the complex molecules of the fluid rock. Secondly, great osmotic pressure is set up

John D. Comrie

in the magma. Water, therefore, continues to be taken up till just before the pressure is as great as the weight of the overlying magma column, and the magma becomes saturated with water in the gaseous state, thus increasing gradually in volume. This causes it to rise in any outlets, such as the pipes of neighbouring volcanoes. Another factor then comes into play. At ordinary temperatures, water is an extremely weak acid, but with rising temperature and pressure, the properties change. At 300° C., water and silicic acid are about equal in strength. At 1000° C., water is 80 times as strong, and at 2000° C., over 300 times as strong as silicic acid. Thus at 2000° C., or thereabouts, water decomposes the silicates in the magma, but as the magma rises towards the surface and cools, the reverse process sets in and the water is again set free. The pressure of the water vapour rises, therefore, notwithstanding the falling temperature, and if the water is sufficiently near the surface, and therefore under diminishing external pressure, some of it will pass into steam with explosive violence. A volcano, therefore, in eruption is an example of action similar to but stronger than that of a geyser. Volcanic action is thus intimately dependent on movements of the earth's crust.

Although rapid movements of the earth's crust are the most obvious and striking in their effects, and although movements on a vastly greater scale have occurred in earlier times, slow movements of a similar nature are even more important in determining the conformation of the earth's surface. These have given rise to the continents and ocean basins which form the broader features of the earth's surface, exemplified in the case of the American Continent and the Atlantic Ocean, where the boundary between sea and land is of the nature of a simple monoclinical flexure. In the case of the other continents, this has been complicated by the interference of thrusts which have introduced mountain-building movements. It was assumed by Sir Charles Lyell and other geologists that by reason of these movements there had been frequent interchanges of place between land and sea, to account for alterations of marine and freshwater sediments, although at the present day most of these are explained by relatively local changes. Depressed regions, like the Mississippi basin, however, show ample evidence in their marine sediments of having at one time been at the bottom of a deep sea. Western Europe also



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Volcanic Action in Epidemic Diseases

is regarded as having been in previous times the seaboard of the great Eurasian continent.

Arguments, based on the geographical distribution of animals, have been brought forward by zoologists, for example, by Dr A. R. Wallace, to prove the existence in early times of great continents, especially in the southern hemisphere, connecting the present lands across the Pacific and Atlantic Oceans, so late as tertiary times.

Strong corroborative evidence with regard to submergence of land on a grand scale, either gradually or with considerable suddenness, is contained in the various traditional accounts of a deluge found among primitive peoples. The best known of these is the Mosaic account in the Book of Genesis. This fact, as it concerns the former existence of land in the Atlantic, will be considered later, in connection with its remote effects in the production of disease.

Direct Morbific Effects of Volcanic Action.—From a perusal of the works of Dr Parkin, especially his treatise on epidemics, it appears that he entertained the hope that evidence would at some time be found that volcanic explosions directly produced some change in the atmosphere which conduced to the immediate outbreak of epidemics. Investigations since his time have shown that the composition of the products of volcanic outbursts is similar to that of other forms of combustion. It has already been stated that water, in the form of steam, is one of the main substances produced during eruptions and that gaseous compounds of sulphur are very common, especially sulphur dioxide and sulphuretted hydrogen. Carbon dioxide is also given off in large quantities during the later phases of activity in a volcanic district. Most of these substances when in high concentration are deleterious to life of all kinds, and have in some well-known instances produced immediate and widespread fatalities among human beings in the neighbourhood of an eruption. In the literal acceptation of the term, this is, strictly speaking, an epidemic, although not in all probability in the sense intended by Dr Parkin. A classical example of this kind is found in the eruption of Vesuvius in A.D. 79. That part of the eruption which destroyed Pompeii consisted of a discharge of ashes and gases which overwhelmed great numbers of people, including Pliny the Elder, who had gone to Pompeii to investigate the eruption. The eruption and the effects it produced on human

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life are described in the celebrated letters of Caius Plinius Secundus to the Emperor Trajan.¹

A modern example, with the same effect, occurred in the year 1902 in the West Indies. The chain of the Antilles Islands is a volcanic region along a line of earth-folding, where eruptions have occurred from time to time. In May 1902, two separate series of eruptions occurred in the islands of St Vincent and Martinique. The eruptions of St Vincent were investigated by Dr Flett and Dr Anderson,² while those of Martinique were recorded by Lacroix.³ In the northern part of the island of St Vincent is a volcano known as the Soufrière, which rises to a height of 4000 feet and is 8 miles in diameter at its base. At its summit, before the eruption, was a large crater 1 mile in diameter, which contained a lake strongly tintured with sulphuretted hydrogen. The volcano had been dormant for ninety years, except for this gaseous exhalation through the water. After some premonitory earthquakes during a period of twelve months, an eruption began on 6th May 1902, with boiling and overflow of the crater lake. Next day, the eruption became more violent and a great black cloud of gases and incandescent dust appeared, rushing down the side of the mountain and burning and destroying everything in its path. Within the area traversed by the cloud, all vegetation was destroyed and all animals and human beings were killed except those in tightly-closed buildings. In Martinique, Mont Pelée showed similar features and a cloud of the same type rushed down over the town of St Pierre, which was wiped out with the death of 30,000 inhabitants. The gases of these clouds contained sulphuretted hydrogen and sulphur dioxide, but the most abundant gas in both cases was steam.

In the intervals between their eruptions many volcanoes give off steam and gases from their principal craters and minor openings; and, as the volcanoes are passing into the solfataras stage of gradual extinction, these are the only products given off. The evolution of these chemically-active gases leads to deposition of peculiar minerals round the openings, and causes great alteration of the surrounding rocks. This process may have, in isolated cases, some influence upon the water-supply of a district and thus lead to the presence of endemic disease; but the taste of such water is so obvious that such an action can be exerted only in isolated instances, and, indeed, such waters are commonly used for the remedial action they exert.

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The presence of carbon dioxide and sulphurous compounds collected in caves and depressed localities is sometimes productive of death in animals and human beings. Something of this nature gave rise to the old myth of Lake Avernus, over which it was said that no bird could fly. The Upas Valley of Java owes its deadly properties to a layer of similar gas collected at the bottom; and caves occur in Italy and at Royat in Auvergne, entry into which is liable to result in death. These, however, are merely local collections of gas, which owe their poisonous effects to the formation of the ground and which, when diluted with a large quantity of air, are quite innocuous. An instance of this local effect of gases is given by Daubney.⁴ Describing a tour through the volcanic province of Basilicata in South Italy, he says in regard to the town of Mina: "Since the cutting down of a wood between this town and the mephitic lake, a disease has broken out amongst the inhabitants due to the inhalation of deleterious gases, which are now much more noticeable in the town." He describes this disease as being characterised by marked pallor of the complexion. Another instance is recorded by de Corogna in a work on the eruption of Santorin.⁵ He states that many cases of bronchitis and other troubles, due to irritation of the air passages, arise from the presence in the air of sulphuretted hydrogen and other irritating gases.

The effect of such gases discharged from volcanic vents after they have been dissipated through the atmosphere, must in every case be very small when compared with the discharge of similar gases from the factories of even a moderately large manufacturing town. Only in cases where the gases are locally produced in great concentration, as at Pompeii and St Vincent, can the effect on human life and health be appreciable. Such concentrations, are at the present stage in the earth's history, of isolated and temporary occurrence only.

Indirect Morbific Effects of Volcanic Action.—Less direct effects of volcanic action than those due to the products of eruption may be caused by such influences as the social disturbance and poverty following an eruption or an earthquake, or more insidiously, by such a circumstance as the disturbance of water-supply through earth movements, leading to its contamination.

In a map prepared by Geikie,⁶ showing the geographical distribution of volcanic activity, the countries most subject to

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earthquakes are seen to be Portugal, Italy, Baluchistan, Afghanistan, Bengal, Japan, Mexico, and the Pacific coasts of South America. In these regions, the most prevalent diseases are as follows: Portugal, malaria and enteric fever; Italy, enteritis, diarrhoea, enteric fever and malaria; Baluchistan, enteric fever and dysentery; Afghanistan, enteric fever and dysentery; Bengal, enteric fever and cholera; Japan, cholera; Mexico, malaria and dysentery.

It appears, therefore, that enteric fever and other diseases associated with infection of the intestinal tract are particularly prevalent in volcanic districts. Such a fact may have been responsible for Dr Parkin's view that there was a direct connection between the two classes of phenomena. So many other factors, however, such as the heat, the climatic conditions, the soil, relative poverty of the people and primitive conditions of hygiene, enter into consideration that it is impossible fairly to draw such a conclusion, and, indeed, modern investigation has proved some of these factors to be the predominant causes.

A connection between the disturbances of drain- and water-pipes produced by earthquakes, and the occurrence of epidemics of these diseases, can be traced in several individual instances, *e.g.* in regard to the town of Yokohama. This place is situated on one of the chief lines of volcanic activity in Japan and is constantly subject to earthquake shocks. The attention of the municipal authorities was forcibly directed to recurrent epidemics of cholera during the years between 1870 and 1890, and an official investigation by Dr Geerts proved a close relationship existing between the use of polluted water and the virulent development of cholera.⁷ Turner,⁸ dealing with the construction of the Yokohama waterworks in 1887, reported on the result of a systematic investigation into the nature of the water-supply of Yokohama, in which he found that 14·5 per cent. of a large number of samples of water taken from various parts of the town showed contamination by sewage. He also drew attention to the defective condition of the drains of the town and to the readiness with which the pipes conveying water were fractured. A new water-supply and drainage system, made subsequent to that date, resulted in great improvement of health in the town in regard to epidemic disease, as mentioned by Davidson.⁹ A somewhat similar state of affairs is recorded in regard to the health of Naples, which is also liable to frequent earthquakes from its neighbourhood to

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Vesuvius, as follows: "The improvisation of the drainage and water-pipes culminated in a severe cholera epidemic in 1884, during which the total mortality rose to 6971 persons out of a population of 504,700. . . . The drainage works consisted of some 50 principal sewers emptying into the Bay of Naples, but owing to numerous leakages they had led to all kinds of insanitary dangers."¹⁰

Another method in which eruptions may increase indirectly the prevailing incidence of disease is through raising the humidity of the atmosphere. The torrential rains produced by the escape of steam from volcanoes have been mentioned. If the process is prolonged, the humidity may be raised over a considerable period and area. Rogers has recently shown, as regards India that, certain diseases are markedly influenced by rainfall. Thus a high rainfall, either as regards locality or over a season, is associated with a high prevalence of leprosy,¹¹ while humidity has a similar marked effect upon phthisis death-rates.¹² Other causes than volcanic eruption are of much greater frequency and importance in relation to increase of humidity, but this possible result of volcanic action is at least worthy of mention.

Malaria in Greece affords an example of recurrent epidemics of disease, due ultimately to changes of land surface brought about in part by volcanic action.

A marked change took place in Greek character during the fourth century B.C. The outlook on life changed, patriotism decayed, and lofty aspirations almost ceased to stir the hearts of men. In art, there appeared a tendency to sentimentalism, and philosophy became pessimistic. Some schools of thought even took absence of feeling and absence of care (*ἀπάθεια*, *ἀραξία*) as the highest goal of human endeavour. By 300 B.C., the Greeks had lost much of their manly vigour and intellectual strength, and this process of degeneration continued through the Middle Ages.

Recent investigations into the prevalence of malaria in Greece and into its effects upon the inhabitants suggest that this agency may have been at work during the fourth century B.C. Malaria, unlike many other diseases, does not strengthen a people by weeding out the unfit, its general effect being to lower the vitality of a people without causing a large number of deaths. Recent statistics show that some 40 per cent. of the population of Greece at the present day have this disease,

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and in many districts every child passes through a succession of weakening malarial attacks. Hippocrates mentions that the dwellers in marshy places suffer from enlarged spleens,¹³ and numerous other references of this period are discussed by Jones, Ross and Ellett.¹⁴ The disastrous expedition of the Athenians against Egypt seems to have brought back the disease as an epidemic to Attica. In 425 B.C., malaria appears to have broken out in the expedition to Sphacteria; and, in the Peloponnesian War, districts became overrun by the disease, owing to large tracts of the land going out of cultivation.

The continuance of malaria in Greece seems to have been due to the increasingly swampy nature of the land, following upon a general rise of the shores of this country. One very definite evidence of this may be given. Thermopylæ, a celebrated narrow pass, the site of hot springs, which leads from Thessaly into Locris, was, in 480 B.C., defended by Leonidas with 300 Spartans against the advance of Xerxes. At this time the pass was a narrow track about 14 yards wide under the cliff.¹⁵ In modern times alluvial deposits and deposits by the volcanic springs, from which the pass derived its name, have widened the land to a breadth of $1\frac{1}{2}$ to 3 miles of swampy ground.¹⁶ Evidences of a similar rise of land are found elsewhere on the coasts of Greece. Thus the recurrent epidemics of malaria which have now settled down into an endemic infection of the population can be traced back to influences ultimately connected with volcanic movements.

Plague.—An important example of an epidemic disease which may, with reasonable probability, be traced back to the indirect effects of volcanic action, is afforded by the spread of the *Black Death* in the thirteenth and fourteenth centuries. This epidemic was of enormous politico-social importance, because, owing to the great number of people who died from it during the fourteenth century throughout Asia and Europe, and still more perhaps owing to the change in habits called forth by it, a check was imposed upon that development in culture which is evident in the thirteenth century, and which did not again show much progress until the Renaissance of the sixteenth century.

The Black Death of the fourteenth century, which was plague in the modern acceptance of the term, and which showed at times a pneumonic form, comes well within the scope of historical investigation. We can therefore form some

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idea as to its origin and the causes of its propagation, of which Hecker has given a detailed account.¹⁷

Two medical accounts of this epidemic have come down to us. One is by Guy de Chauliac, who notices the fatal coughing of blood, the other by Raymond Chalin de Venario, an experienced scholar, who records various other symptoms, including the black spots and the startling suddenness with which those who were affected by this form of plague died. It appears, mainly from the account of de Guignes,¹⁸ that the appearance of the plague was preceded by a time of great volcanic manifestation, especially in China. Violent torrents of rain about Kingsai, at that time the capital of the Empire, were noted; and according to Chinese tradition, more than 400,000 people perished in the floods. The subsidence of a mountain, Tsinchou, is also noted. A little later, inundations were experienced in the neighbourhood of Canton and again Kingsai was visited by an earthquake which accompanied the subsidence of the mountains of Ki-ming-chan and the formation of a vast lake more than 300 miles in circumference. Drought, famine and pestilence followed upon these physical disasters. In Europe, too, there seem to have been signs of volcanic activity. Etna erupted in the year 1333, although there was no other eruption in the same century, either of Etna or of Vesuvius. On the 25th January 1348 an unexampled earthquake occurred in Greece, Italy, and the neighbouring countries, from which many cities suffered considerably and whole villages were destroyed. Again, in 1338, Kingsai was visited by an earthquake of ten days' duration, and from this year till 1342 there was in China a constant succession of inundations, earthquakes and famines. Again, in 1343, the subsidence of the mountain Hong-tchang in China, is recorded along with a destructive deluge, and in other Chinese provinces torrential rains and inundations occurred which destroyed several cities. These destructive natural phenomena appear to have lasted in China until about 1347.

The plague appeared at Avignon in January 1348, and its occurrence here was described by Guy de Chauliac, who observed it from January to August of that year and again twelve years later. In Florence, the disease appeared in the beginning of April 1348. In August 1349 it broke out in England, where it advanced so gradually that a period of three months elapsed before it reached London. In November 1349,

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it reached Sweden, that is, almost a year after its commencement in Avignon. In Russia, it did not make its appearance until 1351, more than three years after it had broken out in Constantinople. The epidemic thus made a circuit through Europe by way of Constantinople, Southern and Northern Europe, England, the northern kingdoms and Poland, before it reached Russian territories.

With regard to its serious effects, it is recorded that in Florence there died 60,000 people; in Venice, 100,000; in Paris, 50,000; in Avignon, 60,000; in London at least 100,000; and in Norwich, 51,000.

If we seek for some cause which may form a connection between the physical disasters of the time and the gradual spread of outbreaks of the plague from east to west, this may well be explained by some factor which would naturally move from east to west and carry the contamination of the plague with it.

In the earlier part of the nineteenth century, the general idea was one of rains, floods and failure of crops, followed by "a thick, stinking mist which advanced from the east and spread itself over Italy." This, for example, is given by John Caius to explain the origin and spread of the sweating sickness which was an epidemic disease that, after an interval of a century, followed the Great Plague.¹⁹ Such an idea probably animated the opinions of Dr Parkin. Modern investigation has shown that individual attacks of plague are due to the bacillus discovered independently by Kitasato and by Yersin during the epidemic at Hongkong in 1894. This bacillus is conveyed from person to person, as the Bombay Plague Committee showed, by the bites of insects, especially of the rat-flea. In the mass, as the Bombay Plague Committee has also shown, the fleas are very commonly conveyed by rats.²⁰ More recent epidemics have been shown to be associated with epidemics among other rodents. The Bombay Plague Committee showed that the epidemic in Bombay in the year 1906 affected first *mus decumanus*, followed about a fortnight later by an epidemic among *mus rattus*, and followed in a parallel curve about a fortnight later by an epidemic of similar extent among the human population.²¹

The spread of the fourteenth century epidemic admits of explanation in the light of these modern discoveries. The long-tailed rat, *mus rattus Alexandrinus*, was originally a native

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of India, and from this country it gradually penetrated to all parts of the world, exterminating weaker species of indigenous rats. This black rat is first mentioned in English literature in the fourteenth century. In *The Vision of Piers Plowman*, by William Langland in 1362, mention is made of the hordes of rats as an important social occurrence: "A route of ratens and smale myce moe than a thousande." After this followed the advance of the more powerful brown rat, *mus norvegicus*, which is distinguished by greater size, brownish-grey colour and a fierce and cunning disposition, by which it eventually overcomes all allied species with which it is brought in contact. Its original home was some part of North Asia, from which it has spread to all parts of the world, driving out the black rat before it. It appears at an early epoch to have invaded China and become established there, and it migrated westwards early in the eighteenth century, first crossing the Volga in 1727 and reaching Britain in or about 1730. Its predecessor, the black rat, first reached Europe in the thirteenth century, and apparently there was at this time a great migration from the east of the black rat, driven out from its original habitat by the incursion of the brown rat.²²

The cause of these widespread movements among the rats may almost certainly be attributed to some physical influences, such as the volcanic disturbances, inundations, and their consequent famine, in China early in the fourteenth century. We have thus a chain of events, beginning with vulcanicity and with earth movements in China, followed by floods and famine causing a migration of the rat population, which drove the brown rat into the territory of the black rat and caused the latter to escape westwards, the transmission westwards of the plague coinciding with the appearance of hordes of rats, and the gradual infection of successive races and nations of human beings by the plague bacillus.

Remote Morbific Effects of Volcanic Action.—The separation, for prolonged periods, of parts of the earth's surface by volcanic action, with a consequent limitation of certain diseases to isolated races, islands or continents, affords another manner in which a casual relationship may be seen between epidemics and vulcanicity. So long as a constant coming and going is maintained among living beings, their diseases maintain a fairly uniform level of incidence. When intercourse has been cut off completely, some diseases tend to die out on one or other side

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of the barrier, with the result that immunity to them is lessened or lost, and when the disease is reintroduced it is apt to spread in startling epidemic form. Historic examples of this are found in the case of smallpox, measles and syphilis. As the epidemic of the last-named disease in the fifteenth and sixteenth centuries is of great social interest, its connection with this form of geographical isolation will be traced.

Geologists at the present day recognise five European continental periods with intervening marine epochs. During the fifth continental period, a new system of folds was formed and the Alpine system including the Alps, Carpathians and most of the mountain chains of Southern Europe arose, isolating various arms of the sea. Most of the elevation lay far to the south of England, the only traces of folding found so far north being the Wealdon anticline and the sharp folds of the Isle of Wight and other parts of the Hampshire basin. Movements of great magnitude, however, occurred in the north-west. Vast volcanic deposits of basalt had already been in existence, stretching from the Western Isles of Scotland and from Spitsbergen, Franz Joseph Land, etc., to Iceland. That these had been formed on dry land is obvious from the fact that in many places the flows of lava include between them old soils containing plant remains and land shells. This northern continent had spread over a large expanse of the Atlantic in eocene times, but later disappeared, leaving only a few upstanding blocks to indicate the former extension of the enormous plateau. Such blocks are found in the Western Hebrides, the Faroe Islands, Staffa, the north of Ireland and Iceland.

The great amount of detailed study which has been carried out on the rocks and physical geography of Western Europe has afforded ample evidence that large parts of the earth's surface in this region have been alternately raised into land and depressed below sea-level. It is obviously easier to find evidence of cases in which the land has been raised than of those in which areas have disappeared beneath the surface of the sea, since in the latter case, the rise of the water conceals the evidence.

One of the most demonstrable cases of change in level is to be found in Sweden. This was investigated by Lyell in his *Principles of Geology*. Early in the eighteenth century, the apparent rise of the sea in Southern Sweden attracted the attention of Celsius, who estimated its rate to be about 40 inches per

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century. In 1749, Linnaeus measured the distance between a large stone and the sea at Trelleborg, and in 1836 the distance was found to have decreased by 100 feet. According to Lyell, Scania is sinking, while at Stockholm the land is rising at the rate of 6 inches per century, and at Gessle, still further north, the rate of elevation is 2 or 3 feet per century. In the north of Norway and Northern Russia, there is evidence of an elevation of many hundreds of feet in recent times. It, therefore, appears that the whole Scandinavian Peninsula is undergoing a slow tilting movement, sinking in the south and rising in the north. Round the coast of Scotland, the several raised beaches at various levels up to 100 feet above the present high-water mark give evidence of a recent rise of this country.

On the other hand, farther to the south and west, there is conclusive proof that the sea has risen over the land. Around the shores of the British Isles and elsewhere, beds of peat and vegetable soils, below the level of the lowest tide marks, and traces of submerged forests have been found at various points, for example, on the shores of the Bristol Channel. On both sides of the Atlantic, deep submerged channels are found in direct continuation of existing river valleys, which are apparently examples of submergence. This is found, for instance, in the submerged canon of the Hudson River at New York, which can be traced for 150 miles out to sea. Similarly, according to Professor Hull, the channel of the Tagus River can be traced for 50 miles to sea to a depth of 7000 feet, and the Adour River, near Cape Breton, extends for 30 miles into the Atlantic to a depth of between 3000 and 4000 feet.

The distribution of animals in Europe and America in past ages affords also a proof of the previous continuity between the old world and the new. The bear, for example, in Europe dates back to the pliocene period, while in North America it is post-pliocene only. There appears, therefore, to have been a migration from Europe to America of these animals, which belong to the same species in the two continents. The horse also is important in this connection, being an animal which could only spread by land migration. In Europe, horses date back under various forms to the miocene period and the true equus to the later pliocene. In North America, the true equus is post-pliocene, although numerous ancestral forms date back to the miocene and eocene. In South America, equus is the only genus and appears for the first time in post-pliocene times.

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True horses, therefore, appear to have arisen in the north Euro-Asiatic region and to have passed into North America in the latter part of the pliocene period and thence to have spread over considerable distances in South America. Later, however, they became extinct, while in their birthplace in the old world they continued to exist in several varied forms. The elephant, also, is an old-world type abounding in the miocene period in Europe and Asia, and first appearing in America in post-pliocene or later pliocene times. These facts indicate a connection between the northern part of the present eastern and western hemispheres in pliocene times.²³

Man was subject to the same conditions as the animals just mentioned. Recent research has served to push back the prevalence of man, in a somewhat more primitive state than that in which we now know him, to a period much earlier than used to be admitted. According to Keith, man, in a primitive state, represented by the Chellean culture found in the Cromer beds, lived in England as well as in other parts of the continent all through the pleistocene age and may be traced in an earlier phase of culture right back through the pliocene age. Even in the miocene age and the oligocene age, evidences of man have been found in the eolithic implements of the Kentish plateau, of Belgium and under the crag deposits of East Anglia.²⁴

The plant life of the two continents, although now mixed by recent importation, showed in the early part of the nineteenth century, before much immigration of new inhabitants from Europe had taken place, a community of species and genera on the two sides of the Atlantic. In South America, Dr Hooker found that, besides many closely allied species, between forty and fifty of the flowering plants of Tierra del Fuego, forming no inconsiderable part of its scanty flora, were common to North America and Europe, while on the lofty mountains of equatorial America, a host of peculiar species belonging to European genera occurred. Gardner found on the Oregon Mountains of Brazil some few temperate European genera which did not exist in the low intervening hot countries.²⁵ This also speaks for a previous connection between the two continents so near at all events that the seeds of plants could be carried from one to another by birds.

Traditions found among the early inhabitants of Europe, to whom geological observation was out of the question, support these facts. The most vivid tradition is described by Plato in

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his *Timæus*, when, incidentally, speaking of the laws of the ancient Phœnicians, he describes an account given by the Egyptian priests to Solon in regard to an ancient people who had dwelt on an island west of the Pillars of Hercules. The date was fixed by the Egyptian priests as 9000 years before the time of Solon, that is, some 11,500 years before the present time. Speaking of a great warlike power which had then come from the Atlantic Sea and contended with the primitive inhabitants of Greece, the priests said:—

“That sea indeed was then navigable, and had an island fronting that mouth which you in your tongue call the Pillars of Hercules; and this island was larger than Libya and Asia put together; and there was a passage hence for travellers of that day to the rest of the islands, as well as from those islands to the whole opposite continent that surrounds that the real sea; . . . and *the Atlantic island itself was plunged beneath the sea and entirely disappeared;—whence even now that sea is neither navigable nor to be traced out, being blocked up by the great depth of mud, which the subsiding island produced.*”

Similar traditions are preserved in regard to the Greek island of the Blessed or Fortunate Island, the Welsh Avalon, the Portuguese Antillia or Isle of Seven Cities, St Brendan's Island and Homer's account of the island of the Phæcians (Od. VIII), the subject of sagas among many peoples. So persistent were the traditions of these that most of them are indicated in maps of the fourteenth and fifteenth centuries and even formed the object of voyages of discovery. Some localised legends are found in that of the island of Brazil, of Lionesse, and a sunken land off the Cornish coast, of the submerged Breton city of Is, and of Mayda—the French Isle Verte—which until 1853 was marked on English charts as a rock in 44° 48' N. and 26° 10' W.²⁶

The various facts bearing upon the origin, history and disappearance of this Atlantean race have been collected and published recently by Lewis Spence.²⁷

All this evidence both from modern geological study and from traditional folk-lore seems to indicate conclusively the presence of a continental land between Europe and America, with numerous intervening islands, in the early days of European civilisation. Whether there was a complete continuity by land, or whether the continuity was interrupted by channels across which primitive peoples could pass in small ships, is

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immaterial. In any case, intercourse, both for warlike and peaceful purposes, would be relatively easy and would explain the similarity on both sides of the Atlantic of plants and animals, as well as of customs and diseases among the primitive human inhabitants.

If we accept as a fact that a continental island or series of islands in early historic or prehistoric times bridged over the waste of sea between Europe and America and that this land disappeared as the result of vulcanicity, we are afforded an explanation not only as to some of the puzzling facts in regard to the similarity of flora and fauna on the two sides of the Atlantic Ocean, but also with regard to some points difficult to understand in connection with disease.

One of these points concerns the origin of syphilis. The vexed question of the origin of this disease was first critically discussed at the meeting of the International American Congress held at Madrid in 1882. It has been held by some authorities that the disease existed from early times both in America and in the old world. Others have maintained that it broke out in Europe for the first time about 1492, subsequent to the discovery of the new world.

In support of the former view maintaining the antiquity of this disease in the old world some evidence is obtained from bones unearthed by the archæological survey of Nubia,²⁸ showing that periostitis and other changes characteristic of syphilis are discoverable in the bones of ancient Egyptians. Vorberg in a recent publication gives illustrations of two bones which he holds to be syphilitic and which, coming from a burial cave in the Petit Morin valley, are estimated to date from the Neolithic period.²⁹ Various ancient writers have referred to symptoms which might be due to this disease. Guy de Chauliac in particular, writing about the middle of the fourteenth century, more than 100 years before the discovery of America, describes under the headings of *morphœa* and *acute leprosy* cutaneous symptoms which bear a close resemblance to syphilitic lesions. These would seem to point to the occurrence in the old world of a form of the disease in pre-Columban times, differing, however, from the virulent form which affected Europe as an epidemic in the sixteenth century.

The two theories regarding its origin are reconciled and the virulence of the sixteenth century epidemic is explained, if we suppose that in the 11,000 years during which a com-

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plete severance had been maintained between the two continents the organisms responsible for the disease were gradually being modified as they occurred on the far side of the Atlantic. When the disease with its causal spirochete was transferred from the West Indies in 1492 it would find the people of Europe unprotected against the new strain of spirochete, to which there had been no opportunity of gaining immunity.

That a virulent form of the disease was transferred from America to Europe in 1492 is supported by the following considerations:—

The disease first attracted special attention during the year 1494-95, while Charles VIII. of France was conducting a campaign in Italy and particularly during the stay of the French army at Naples between February and May 1495. By June 1495, there are records of the presence of the disease in towns in the north of Italy and neighbouring countries. The contemporary writers of several nations paint the outbreak of the disease in the darkest colours.³⁰

Ruy Diaz de Isla, who was in practice in Barcelona in 1493 and later in Seville and Lisbon, published between 1510 and 1520 a "Treatise entitled, Fruit of all Saints against the disease of the island Espanola, by Master Rodrigo de Isla, surgeon and citizen of Lisbon, to the common and general good of those suffering from the disease in question, commonly called 'Bubas.'" In this treatise the writer states that syphilis was unknown in Europe before the year 1493, that its home is America, and that the crew of Columbus had brought it back from the island of Espanola or Haiti after this discoverer's first voyage. Diaz de Isla had treated several sailors from the squadron suffering from this disease in Barcelona. In the army of Charles VIII. were included many Spaniards infected with the disease. The author describes a method of treatment in use among the Indians by means of guaiacum and other vegetables. Oviedo, who obtained information concerning the new world from Columbus himself, is in agreement with Diaz de Isla in regard to this origin of the disease and declares it to be a disease of the Antilles and the central American continent.³¹ Las Casas, who went to Haiti as early as 1498 and made many voyages in Central and South America, mentions this disease as being at the beginning very dangerous to the Spaniards.³² The Franciscan Father

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Bernardino de Sahagun, who took down communications from the Aztec natives in South America, mentions a cutaneous disease apparently syphilis, known as "nanavatl," and connected with a solar myth.³³

With regard to the rapid spread of the disease, mention is first made of it in England in 1497.³⁴ It appeared in Bristol, and is mentioned in the Edinburgh City Records of 1497. In this year James IV. published a decree ordering all persons suffering from "grantgore" to leave Edinburgh and to be treated upon the island of Inchkeith.³⁵

These references sufficiently indicate its virulent and epidemic nature on its first appearance, a fact which is readily explained in the light of the prolonged restriction of its distribution caused by the earth movements described in the early part of this chapter.

Another example of disease of which virulent epidemics have broken out in consequence of prolonged geographical isolation, brought about originally by the forces of vulcanicity, is afforded by certain outbreaks of smallpox. Thus, the continent of Australia, first settled in 1788, remained absolutely immune from smallpox up till 1838, when the disease appeared at Sydney, having been imported probably from China. The epidemic was, however, prevented from attaining disastrous dimensions by rigid sanitary measures. In many of the island groups of Polynesia, the disease has been found to spread much more widely and to be much more destructive than in Australia. The Hawaiian Islands were visited by smallpox first in 1853, when a ship brought it from San Francisco to Honolulu, and in eight months the disease carried off 8 per cent. of the population.³⁶

The first importation of measles among a native population hitherto isolated from a remote epoch has similarly caused violent epidemics in several cases. One of the most notable of these was the epidemic of measles in the Fiji Islands in 1874. In the account given by Squire, the disease was introduced from Sydney in this year and carried off 20,000 of the natives, constituting one-fourth to one-fifth of the whole population.³⁷

Such instances of disease having broken out in a virulent epidemic among a population isolated from remote ages and therefore devoid of any immunity, are not likely to occur in the future, in view of the greatly-developed intercourse which has taken place between all parts of the earth's surface within the past fifty years.

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Volcanic Action in Epidemic Diseases

Conclusions.—(1) The idea which was prevalent about the middle of the nineteenth century that the outbreak of epidemics might be dependent upon phenomena connected with volcanic action has been superseded by theories connected with the development of bacteria and other minute forms of life.

(2) Conceptions in regard to the nature of volcanic action have greatly widened since that time; but the gaseous products of volcanic eruptions have been shown to be of the same chemical nature as those produced by other forms of combustion and in the explosive type of eruption to consist principally of steam.

(3) Direct morbid effects may be produced by volcanic products, but these effects are noticed on a large scale only on rare occasions. Volcanic products, when diluted by the atmosphere, are usually in too small concentration to produce any appreciable effect.

(4) Indirect effects are sometimes traceable to volcanic action, as by the disturbance of water-supply and drainage systems, which may be brought about by earth movements. Past epidemics of some diseases can be traced to indirect effects of volcanic action, although from the better understanding of matters affecting the public health, these effects are now less marked and are less likely to be produced in the future.

(5) Some remote effects of long past volcanic action may be traceable in the restriction of certain diseases to races and peoples who have been isolated by such volcanic action, and in later excessive incidence among non-immune people. Owing to increasing rapidity of transport facilities between different parts of the earth's surface, the possibility of this effect has now almost entirely disappeared.

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AMYLOIDOSIS.

By WILLIAM SUSMAN.

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INVESTIGATIONS have shown amyloid disease to be due to a combination of factors. 1. It is observed as an accompaniment of a large variety of infective and toxic diseases, particularly in those cases in which a discharging lesion is present. 2. It affects especially the spleen and the liver. 3. The condition can be produced experimentally by the injection of sterilised broth cultures of *Staphylococcus aureus*.¹ 4. Experimental investigation has shown that the spleen is of special importance in amyloidosis because the injection experiments are invariably negative in animals from which the spleen has been removed, whereas the control experiments on normal animals give positive results in 30 per cent. of the cases.¹ The laying down of amyloid substance therefore is in some way related to a derangement of an active splenic function. 5. The chemical analysis of amyloid shows that it has a variety of forms. These forms can be regarded on the one hand as different phases in the process of a physico-chemical change in any one organ, e.g. pre-amyloid, and achro-amyloid as suggested by Lubarsch,⁶ while, on the other hand, the variations in composition as seen in different organs may be determined by the specific metabolism of the organ attacked. This is suggested by the results obtained by Wells.⁴

In view of the complexity of this process, the following investigation of a series of cases was undertaken with the purpose of discovering how far the microscopic study of the distribution of amyloid in the spleen, liver, kidney, and intestine throws light on the nature of the process. It was further attempted to determine the particular structure, the derangement of which leads to the deposition of the amyloid substance.

The material was obtained from nine cases of amyloid disease accompanying a variety of conditions. The tissue was fixed in alcohol or Pick's solution. Sections were stained with methyl violet.

The following is a result of a microscopic study of the above cases:—

Spleen—1. *Diffuse Type*.—In many sections the capsule is uniformly thickened. There is frequently a diffuse deposit of

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amyloid in the subcapsular region, but more often this area stains diffusely with a blue reaction.

The most marked amyloid lesions in the splenic pulp are under the endothelium of the sinuses. The cells thus embedded have atrophied. A positive intracellular reaction with methyl violet was observed in a few cells forming the splenic reticulum. There is a well-marked hyperplasia of pulp tissue and an abundance of sinuses.

The malpighian bodies show a variety of lesions.

1. Amylased areas with splenic sinuses are to be found within the apparent boundary of the malpighian body and these are continuous with amyloid deposits in the neighbouring pulp. The lesions may involve only a small portion of the malpighian structure although more extensive depositions of a similar nature are not infrequently seen. Often the lesions are multiple.
2. Other malpighian bodies give a positive methyl violet reaction only in localised areas. This particular type of lesion also exhibits the usual characteristics of affected spleen pulp.
3. In still others, the lesion is entirely one of the malpighian body. Amyloid has collected in greatest density at the periphery and distinctly within the actual boundary of the malpighian body, while the surrounding pulp is either free or only slightly involved.

The walls of the smaller arterioles and capillaries of the malpighian bodies and splenic pulp are involved completely except for the thin intimal coats. The lesions in the larger vessels vary from an extensive infiltration of the adventitia and media to localised deposits in that part of the adventitia which borders on the media. Very many of these vessels of the larger type are free from amyloid.

These localised mural deposits of amyloid have several interesting features. Many are enclosed in endothelial-lined cavities which by position and structure are recognisable as lymph spaces. The indications are that the lesion first appears in the lymphatics and walls of the smaller branches from which amyloid spreads by continuity until it reaches the larger vessel. If a transverse section be made at or about the point of

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division it will appear that the larger artery has a localised mural lesion, whereas it is the smaller branch which is affected up to the point of division from the larger vessels.

Widespread depositions in the arterial coats were repeatedly traced to this type of initial lesion.

2. *Sago Type*.—The capsule in most sections is not obviously thickened. However, only a relative estimate which takes into consideration the previous thickness of the capsule and the degree of splenic enlargement can be of any value.

The pulp is hyperplastic but sinuses are relatively few. There is a conspicuous increase in the number of capillaries and smaller vessels.

In general, the amyloid lesions are very obviously localised and are not restricted to the malpighian bodies. Frequently the malpighian body, together with the surrounding pulp, is embedded in a moderately uniform mass of amyloid. There is nothing to indicate that one lesion has not affected both at the same time.

The deposition in the pulp is not limited to the subendothelial zone of the sinuses but has become more widespread.

In at least one series of sections many individual reticular cells gave a positive intracellular reaction.

The malpighian bodies, on the whole, are not prominent and are very often amylosed. Lesions in them vary considerably. Many are completely embedded in amyloid, while their arteries often are not affected, especially if the vessel be of the larger type. However, their smaller arterioles and capillaries are usually completely amylosed, even when the "body" includes a medium-sized non-affected vessel.

The accumulation of amyloid at the periphery of many malpighian bodies is very pronounced. Although amyloid material may at the same time be present both in the inner portions of the malpighian bodies and in the surrounding pulp, the heavier zone at the periphery is sufficiently marked to warrant consideration as to its probable relationship with the peripheral sinuses.

The general condition of the vessels in the sago waxy spleen is essentially the same as in the diffuse type. But a study of these sections elucidated a few points. As in the diffuse type, the smaller vessels and capillaries are affected most extensively, and in the larger vessels the changes are localised, as has already been described. However, a pre-

amyloid substance can also be seen in the mural tissue spaces. Longitudinal sections of vessels show the changes to be perivascular in their initial stages.

Liver—1. Early.—In the early phase amyloid changes are limited almost entirely to the smaller arteries of the portal tract in which the lesions involve the greater part if not the whole of the vessel wall. Of the larger arteries relatively few are affected to any degree. Several exhibit localised deposits, while only occasionally is there any marked positive reaction in the adventitia or neighbouring media. The veins are free, although in the walls of several there are masses of a blue-staining homogeneous material, pre-amyloid (Davidsohn).

The liver cells are free from amyloid changes. The Küpffer cells are swollen, and between them and the underlying cells there are small masses of a blue-staining homogeneous material.

2. More Advanced.—Later, most lobules are affected on their middle and outer zones. Positively reacting masses collect between the Küpffer cells and their underlying liver cells. However, very frequently, the amyloid substance infiltrates the surrounding liver tissue which eventually causes atrophy of the involved liver cells, and occlusion of the intercellular canaliculi.

The larger portal tracts are moderately free. A number of the smaller arteries and a higher proportion of the smaller veins have suffered heavily. The central veins contain sub-endothelial deposits.

3. Advanced.—In the walls of the portal veins, collections of amyloid material are seen frequently when hepatic amyloidosis is very advanced. Such lesions when localised represent either affected branches involving the larger vessels at their junction, or, mural lymphatic channels containing masses of the amyloid substance. In the remainder, the mural deposits are usually associated with amyloid within the lumen of the vessel, or in the subendothelial zone of the intima.

In the hepatic arteries, the adventitia and the adventitial media are the sites usually chosen. Here and there the deposits are circumscribed, while in many of the larger type tissue spaces in the media have been preferred.

The hepatic veins are affected chiefly in their smaller branches.

The central veins are extremely dilated. The majority possess globular subendothelial deposits of a light-blue homo-

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geneous material, many of which are intermixed with positively reacting masses.

The periductal vessels of the portal tract are in an advanced stage of amyloidosis, while the bile ducts are unaffected.

Within the lobules the middle and outer zones are the areas most frequently the seat of amyloid deposition. Occasionally the lesion has advanced into the central portion although the distribution here is irregular and more localised.

Kidney—1. *Early*.—In renal amyloidosis the lesion first to appear is in the glomerulus, and localised nodules centering about the capillary tufts are the most prevalent. Occasionally the whole glomerulus is converted into a homogeneous mass of amyloid. At this stage no other amyloid lesions are demonstrable in the kidneys.

2. *More Advanced*.—Circumscribed lesions in the glomerular tufts are again predominant. The walls of the vessels supplying the affected glomeruli have been completely infiltrated. The capillaries about the loop of Henle have been amylosed thus causing the displacement and atrophy of the neighbouring tubules.

3. *Advanced*.—To a moderate extent, the larger arteries exhibit mural deposits of amyloid. These vary from a circumscribed deposition in the adventitia to an extensive infiltration of the adventitia and media. Initial lesions in the vascular lymphatics are frequent findings.

The larger vessels are dilated and the arteries atheromatous.

Very many of the glomerular tufts are entirely amylosed. Of these an appreciable number exhibit an uneven and nodular appearance as the reaction in different areas of the same glomerulus varied in intensity. The afferent and efferent glomerular vessels, the smaller renal arteries and veins, as well as the capillaries in general, show advanced amyloid lesions. The tubules suffer from displacement and atrophy due to pressure exerted by the amylosed peritubular vessels.

Chronic nephritis of a patchy distribution is fairly pronounced. These areas are more extensively amylosed than the rest.

Intestine.—The lymphatics and vascular channels of the villi have been the seat of an extensive amyloid deposition. The epithelium lining the intestine is atrophic and in several areas the cells approach the spheroidal and flattened types.

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Discussion.

Amyloidosis has been produced experimentally by the injection of various substances but without the production of suppuration. It is therefore our first duty to find, if possible, the common factor which exists in the production of both the experimental and the human processes.

Davidsohn¹ and others have produced amyloidosis experimentally by the intravenous injection of broth cultures of *Staphylococcus aureus*, previously killed by heat. Toxins alone have been effective, as seen in animals used for the production of diphtheria anti-toxin. But in general, in the human subject, amyloidosis accompanies chronic suppurative conditions. A similar process is induced experimentally by the injection of turpentine.³

What is the common factor? An organism with its exotoxin, a toxin alone, and a purely chemical substance are all essentially different, and yet the substances can each produce the disease. The common factor in all three is toxicity, and a capacity to damage body tissues. Both of these are present in chronic suppuration as seen in the human subject.

Another coexisting factor in this series is chronic venous congestion, which, according to the post-mortem reports, was present in all cases.

These sufficiently indicate a common process governed by common factors and thereby warrant an investigation as to the causes of the preference constantly shown for certain organs and for certain tissues in those organs.

The spleen, liver and kidneys are chiefly affected, and less frequently the intestine, while rarely nodules have been found in the trachea and other organs. Perhaps, by considering those organs more often chosen by this process, an indication may be found to assist in forming a working basis. The intimate association of the liver and the kidney with the detoxification and excretion of bacterial products and toxins from other sources, the marked response always associated with the spleen under such circumstances indicate that these organs are the ones most liable to alteration through the invasion of organisms or toxins. Moreover, this is emphasised by the fact that the situation of splenic lesions in cases of acute infection and in amyloidosis are strikingly similar.

In the sago type, and to a lesser degree in the diffuse type of waxy spleen, the malpighian bodies are attacked.

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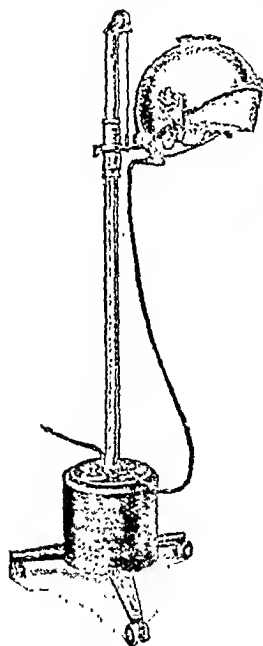
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Amyloidosis

Perivascular amyloid changes were frequent. In both varieties a distinctly heavier deposition of amyloid was repeatedly seen at the periphery of the malpighian body. The situation of these lesions strongly suggests an association of these peripheral deposits of amyloid with the peripheral sinuses of the malpighian body.

The vulnerable points of the spleen in acute infection are much the same. Sections from the spleen of a larger number of such cases show that very frequently there are degenerative areas in the malpighian bodies. Very frequently inflammatory products collect in the perivascular spaces. The peripheral sinuses, too, are often dilated and many have been invaded by hæmorrhage from the surrounding acutely congested pulp.

In short, those organs most liable to bacterial and toxic changes appear to be most vulnerable in amyloidosis. Tissue damage probably plays an important part, but it alone does not explain away the similarity. The whole question will be discussed later when all the data have been considered.

Having surveyed the general factors involved, it is now necessary to note briefly the conclusions of several workers before proceeding to the more detailed phase of the inquiry.

That the spleen may have an essential rôle in this disease suggested itself to Davidsohn,^{1,2} on observing that splenic lesions are the first to appear. This view was strengthened when later, in his experiments, he found that after the removal of the spleen of an animal it was impossible to produce amyloidosis. He, therefore, concluded that the spleen produces an enzyme; this enzyme interacts with a soluble product of cell destruction which has been conveyed by the blood; as a result amyloid is formed.

Schmidt⁶ considered it probable that an enzyme acting on the soluble precursor of amyloid caused its coagulation or precipitation in the tissue spaces and lymphatics.

After studying the chemical content of amyloid, Wells⁴ states that the protein constituent of that substance varies in different organs.

MacCallum's³ investigation led him to the conclusion that amyloidosis results in an infiltration.

The conclusion of these workers suggests that in amyloidosis some splenic product is essential; that the lymphatics and tissue spaces are involved; that each organ affected contributes through cell destruction the protein portion necessary in the amyloid combination; and that the process results in an infiltration.

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Amyloid disease will be studied now in the light of the microscopic findings recorded above. By reason of Davidsohn's results the spleen will be considered first.

In order to appreciate fully the amyloid findings in the spleen the main features of the organ will be reviewed briefly.

The capsule is made up of fibrous tissue including elastic and muscle fibres. Through the rhythmic contraction of the elastic and muscle fibres the spleen pulsates once every minute.⁹ From the capsule fibrous trabeculae containing elastic and muscle fibres penetrate into the splenic substance. The trabeculae give rise to fibrils which form the splenic reticulum. The trabeculae contain the larger splenic vessels and lymphatics.

In the splenic pulp and associated with the splenic arteries are the malpighian bodies which are made up of collections of lymphoid tissue in the adventitia of these vessels.

The malpighian body is irregularly pitted on its outer surface. Into these hollows the surrounding splenic pulp is moulded, thus producing splenic pulp projections. The line of demarcation between the malpighian body and the surrounding pulp is therefore seldom distinct. Generally, large lymph sinuses with their walls in contact, form a large part of the boundary of the malpighian body.

From the malpighian body the splenic artery continues into the pulp. The arterial wall becomes perforated at this stage, allowing the blood to come in direct contact with the splenic pulp.

The structure of the splenic pulp centres chiefly about the numerous minute compartments and the sinuses.

The minute compartments are constituted by (1) a reticulum of fibrils which are derived from the trabeculae and which are covered with branched connective tissue corpuscles or reticulum cells. The branching processes from several cells unite to form the minute compartments above mentioned. (2) Splenic phagocytes which are large mononuclear cells and are found in the interstices.

The sinuses are modified venous channels whose walls also are perforated. They are lined by endothelium ribbed longitudinally by fibrils derived from the reticulum and the layer of endothelium is encircled by similar fibrils continuous with those just mentioned.⁸

It is now possible to trace completely the blood flow through the spleen. On leaving the splenic arteries through the perforation in their walls, the blood makes its way into the small

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interstices of the splenic meshwork. Here the blood cells surround the splenic phagocytes.

On leaving these compartments the blood enters the sinuses and passes from the organ by way of the splenic vein.

The lymphatics of the spleen are of two types. One type has both afferent and efferent vessels. The lymphatics of this group are found in the subcapsular region and in close association with the trabeculae.

The other type of lymphatics were described by Weidenreich.⁷ They are associated with the splenic reticulum, empty into the sinuses and have no afferent or efferent vessels to and from the spleen.

We will now proceed to consider the findings as observed in the various organs.

Spleen—1. Diffuse Type.—The earliest lesion in the spleen is seen in the smaller vessels. Only at a later stage in the process are those of a larger calibre affected. This would indicate that the process was spreading outwards and that the amyloid material was to a great extent a product of the spleen although some of its constituents may have been contributed from elsewhere.

Another feature must be considered here. The finding in several cases of splenic pulp cells which gave a positive intracellular reaction is sufficient to indicate that whereas the amyloid process elsewhere is in the nature of an infiltration, in the spleen intracellular changes may occur as well. But this intracellular reaction was never directly associated with visible collections of amyloid.

Further significance is gained from the fact that in no other organ was hyperplasia constantly present. It may therefore be inferred that the spleen is in a state of increased activity, and an intracellular substance is produced by the hyperplasia and hyperfunction which is sufficiently concentrated to give a faint but distinct positive reaction. This is additional proof that the spleen produces a factor which probably is carried away by the blood stream by way of the splenic sinuses, and assists in the production of amyloid in other organs. That the factor is disseminated by the blood stream is evident from the distribution of amyloid amongst the various organs.

Let us now consider the changes present in the pulp. Lesions in any organ usually centre about some function or action of that organ. In the case of the spleen it is as yet

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impossible to associate the lesions definitely with any function, but the known splenic action may afford some assistance.

The relationship of splenic pulsations with the early stages of amyloidosis is very intimate and important as the following will show.

We will consider the effect of the increased pressure caused by splenic pulsation during contraction. The blood pressure would convert the arteries into relatively non-compressible columns. The malpighian bodies, of firmer consistency than the pulp, become even more so under the pressure of splenic contractions. It has already been stated that available records show chronic venous congestion to be present in every case. Such back pressure would convert the sinuses into firm columns.

With these observations before us, the distribution of amyloid in the pulp of the diffuse waxy spleen can be readily understood, for the deposits are about these comparatively non-compressible parts. It would therefore appear that the splenic pulsations compressed the splenic pulp against these firmer areas, *i.e.*, arteries, malpighian bodies and sinuses, causing a concentration there, of the elements necessary for amyloid production, and the actual deposition occurred in those areas.

The diffuse subcapsular reactions, both blue and violet, tend to confirm this view, *i.e.*, that pressure influences the amyloid distribution in the spleen; and for this reason. In the initial stages of tissue damage diffuse staining is common. Here, evidently, tissue damage is in close association with a capsule, largely muscular, and whose contractions are frequent.

The lesions in the malpighian body are varied. (1) There are one or more portions of amylosed malpighian bodies which very obviously are connected with similarly affected areas in the pulp proper. The amyloid in both localities reacts similarly to methyl violet. As the malpighian body boundary is ill defined and irregular, and as the splenic pulp fits into these indentations, it can be understood how the irregularities or indents in the boundary of the malpighian body becomes more obvious and the splenic pulp which dovetails into these becomes more apparent, when amyloid has been deposited in this pulp tissue surrounding the malpighian body. Moreover, it is also understandable how amylosed areas exhibiting splenic sinuses may be present within the apparent but not real boundary of the malpighian body.

(2) In the microscopic description it was stated that localised

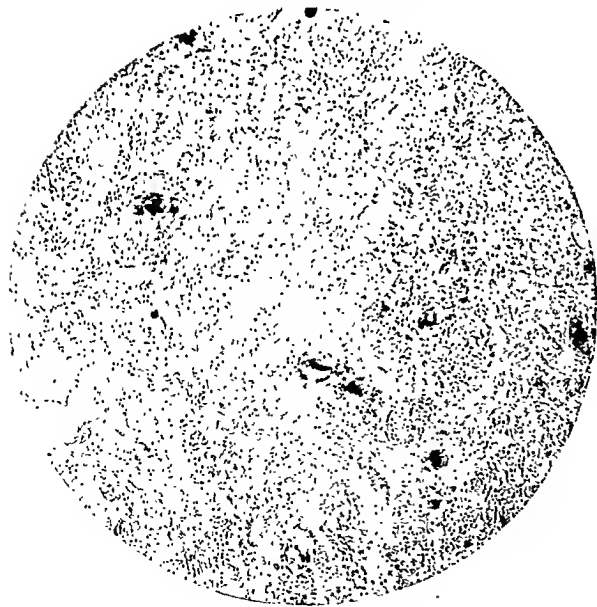


FIG. 1.—Capillaries of the glomerular tuft show extensive amyloid lesions. *FIG. 1.—Kidney. $\times 100$.*
this section.

FIG. 2.—Kidney. $\times 60$.

The walls of the larger arteries are affected only in a portion of the outer media and adventitia, while the wall of the smaller vessels are completely affected. In the larger vein the mural collections are similar to those seen in the portal veins. The peritubular vessels are very markedly involved. In many areas lesions are so extensive that the tubules have largely disappeared through pressure atrophy.

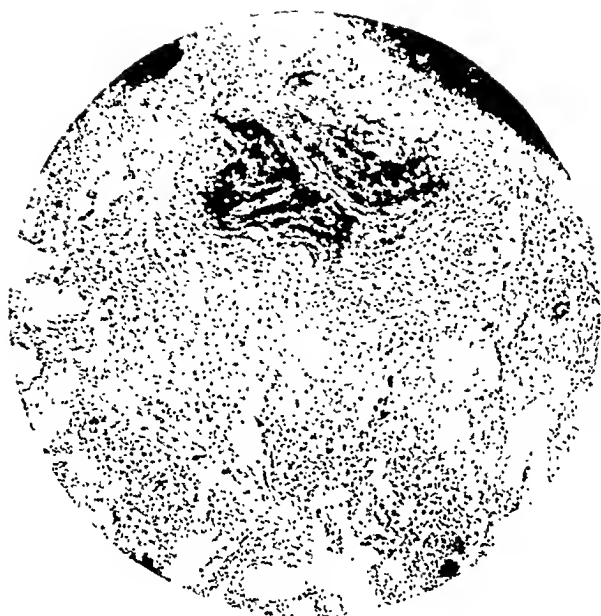


FIG. 6.—Amyloidosis—Spleen (Sago). $\times 60$.

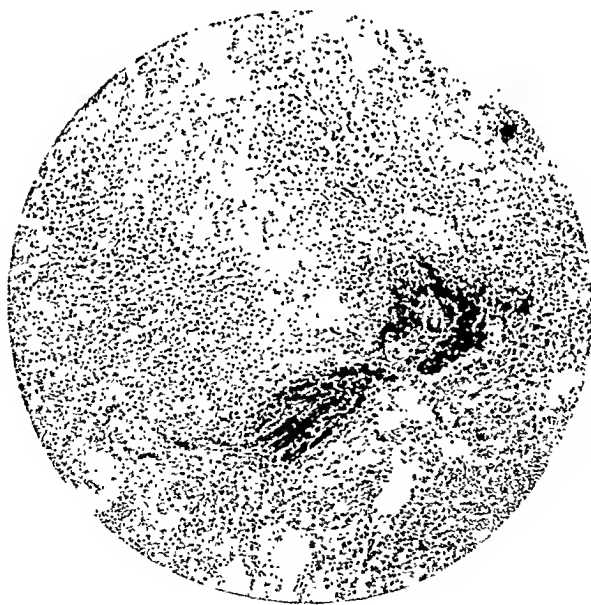


FIG. 5.—Amyloidosis—Spleen (Sago). $\times 100$.

FIG. 5.—Longitudinal section of an artery. The amyloid changes are limited to the adventitial region where the deposit is heaviest and the neighbouring lymphoid tissue. The vessel wall is affected only in a part.

FIG. 6.—The vessel wall is unaffected except in the adventitia where there is a marked deposit. Infiltration has occurred into the malpighian body to a limited degree.

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lesions are present within the malpighian body. These also contain splenic sinuses. Sections cut at right angles to those mentioned in (1) above would give the picture. Hence it is safe to assume that the lesions in both (1) and (2) are in the splenic pulp which had moulded into the crevices of the malpighian body.

(3) Another type of lesion requires explanation, *i.e.* those present particularly at the periphery of the malpighian body. They appear to be in and about the peripheral sinuses. As already stated, this increases the suspicion that the splenic response in amyloidosis is related to that induced by bacterial and toxic diseases.

That amyloid was present in the perivascular and adventitial channels of the arteries and to a lesser degree in the veins was repeatedly seen. There were also collections of pre-amyloid—(a substance recognised by Davidsohn and Lubarsch)—in similar positions. If the splenic sinuses are modified blood channels, they probably are accompanied by minute lymphatics and their perivascular set would be in the subendothelial zone where amyloid is regularly deposited.

The distribution throughout therefore is entirely along perivascular channels: some of these are definitely known to be lymphatic while the others are probably such. At any rate the latter appear to conform in position with those lymphatics described by Weidenreich.

There still remains another question to answer. If amyloidosis in this organ progresses by lymphatics, why should the central artery of the malpighian body alone be affected? More especially is this to be considered, because this body is a collection of lymphoid cells in the adventitia of a splenic artery, the adventitia being a zone commonly occupied by lymphatic channels.

If the splenic pulsations again be considered, it will be evident, on the one hand, that in a compressed malpighian body there is little opportunity for infiltration into its tissue spaces as these to all intents and purposes have been occluded by pressure. On the other hand, there are available perivascular and adventitial lymph channels associated with the splenic artery of the malpighian body. The walls along these passages are sufficiently firm to resist a moderate degree of pressure, and this alternate route would present less resistance to the advance of amyloid or its precursor.

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In general, the vascular lesions therefore indicate that the spread of amyloid has been along the walls of the capillaries, along the smaller vessels, and finally along the larger arteries. The earliest lesion is in the associated vascular lymphatics, both perivascular and adventitial. Amyloidosis has therefore spread by continuity. The direction of spread indicates the spleen as the seat of production of splenic amyloid.

2. *Sago Type*.—Here, again, evidence is rather strongly in favour of the view already expressed. Hyperplasia of the pulp and cells giving an intracellular reaction are two findings similar to those seen in the diffuse waxy spleen. They suggest a similar conclusion, namely, that a splenic function has been strained in order to produce amyloidosis.

The outstanding feature in the pulp is that it contains localised lesions which are irregularly distributed. There is again the outward perivascular spread to imply that the spleen has been the seat of manufacture of this substance. The vascular lesions in the pulp and the malpighian bodies are not essentially different from those in the diffuse type of amylosed spleen.

The malpighian bodies proper have been affected in several ways. Frequently there is a heavy deposit peripherally. But the central artery within such a malpighian body is surrounded by an unaffected area even when that vessel is in part the seat of amyloid change. In others the artery is affected while the lymphoid tissue is not involved. In many, infiltration into the malpighian structures penetrates from the surrounding pulp, and in still others, from the periphery of the malpighian body, while in none is there evidence to show that the infiltration has been from the central artery into the malpighian lymphoid tissue.

What, then, determines the character of the distribution? Again we must consider the influence of splenic contractions. In their absence, a uniform concentration of the various elements necessary to produce amyloid would be lacking. The tendency would therefore be for the formation of irregularly distributed localised deposits such are found in the sago waxy spleen.

In the malpighian bodies the problem is different. These structures, in themselves, are collections of lymphoid tissue in the adventitia of splenic arteries. They are largely surrounded by lymph sinuses. Therefore, if the amyloid precursor spreads by the lymphatics, it can readily be seen how these malpighian

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structures may be involved if they are not under pressure. But the principal perivascular lymphatics of the malpighian vessels frequently are involved alone. For the present an explanation of this preference is not available, except that local pressure from amyloid nodules may have been acting on those malpighian bodies. For this reason the process may have advanced preferably by the perivascular lymphatics, a route which offered less resistance.

Several other features have still to be considered. In the pulp hyperplasia and positive intracellular reactions were noted. The hyperplasia had resulted in a more compact cellular formation than that seen in the diffuse type.

A further contrast exists in that there is a very conspicuous abundance of small vessels rather than sinuses. The amyloid reaction, too, in all organs when the splenic lesions are of the sago type give a more reddish reaction with methyl violet, and this was confirmed by a colour analysis with colour filters. In all, this suggests that although the stimulus may be similar, the splenic response in the sago type of amyloidosis has varied appreciably. Otherwise the general features are similar to those already discussed in the foregoing section.

The process within the spleen has been discussed. Splenic participation can be assumed on a fairly substantial basis. The hypothesis which is implied explains how the amyloid factor is disseminated by the blood stream by way of the splenic sinuses; it further combines the doctrines of Wells and Schmidt by introducing the splenic lymphatics of Weidenreich.

Liver.—The earliest changes are in the smaller vessels of the liver, while the larger vessels and the liver lobules are affected only at a later stage. It would therefore appear that here as elsewhere amyloid was a local product and was spreading outwards. Within the liver lobules the amyloid substance is deposited under the endothelium of the blood canaliculi of the middle and outer zones. Later, infiltration involves the liver cells which then become atrophic. Subsequently, the sinusoids become occluded by amyloid masses. An additional feature is that small masses of amyloid have formed within the lumen of several portal veins but not in any arteries. Therefore, it may be asked, "Does the whole process take place within the portal vein?" Another explanation is possible.

As the wall of the portal vein is very thin, and as many collections of amyloid are separated from the lumen only by

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a layer of endothelium, in a more liquid phase, such as when amyloid is spreading along the lymphatics, a quantity may have permeated the endothelial layer and given rise to those masses seen within the lumen. But why is this not seen in other organs? The portal vein functions as an artery and it can therefore be supposed that it may acquire those lesions to which arteries are prone.

However, another mode of formation is possible. The blood in the portal veins has been drained from a large area where some degree of tissue damage is likely by virtue of the function of those parts. The necessary protein moiety may be present, therefore, in the veins.

The splenic contribution would be abundant, as the splenic vein empties directly into the portal vein. Then all the necessary factors of amyloid production may be present within the portal vein, and endothelial damage due to toxins or faulty metabolism, as from chronic venous congestion, could supply the final necessity, a site.

If Wells' contention be correct, only a chemical examination of these masses, together with a comparison of the results obtained from similar examinations on amyloid found within the liver substance, would prove which of these two processes had actually taken place.

It must finally be observed that the hepatic sinusoids are vascular channels. By reason of the similarity of distribution of amyloid lesions about the various types of blood vessels, and because in the larger vessels the deposition is definitely in lymphatics, it is reasonable to suppose that here, too, some form of minute lymphatics are involved. In the liver, therefore, the disturbance causes lesions essentially perivascular and probably lymphatic in their distribution.

Kidney.—The earliest lesions are in the glomerular tufts in the form of localised nodules. Any of the involved capillaries which had been cut transversely showed these amyloid accumulations again to be peripherally and therefore perivascular. The vessels about the loop of Henle are next involved, together with the larger arteries supplying the glomeruli. At a later stage the glomerular tufts become more extensively affected. The amyloid substance finally reaches the larger vessels through their lymphatics.

In the renal amyloid process, the combination of factors seen elsewhere is again present. The chief excretory structure,

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the glomerulus, is first attacked. By virtue of its function, it is frequently liable to cell damage, and this no doubt accounts for the preference. Amyloidosis then spreads successively to the afferent and efferent glomerular vessels and finally to the larger vessels. Besides the disablement directly inflicted on the kidney by the amyloid deposition, much damage follows through compression of tubules.

One case in particular exemplifies the importance local tissue damage plays in this process. There were the typical lesions seen in chronic nephritis of patchy distribution and in the damaged areas amyloid changes were most marked.

A further point in the process was disclosed by the glomerular lesion in the advanced cases. Besides varying in intensity, the amyloid varied in reaction. In many glomeruli nodules of amyloid were intermixed with blue-staining homogeneous material — pre-amyloid. It clearly indicates that there are stages in the amyloid process and that the process is gradual.

Intestine.—Here, again, the picture is of a similar type. The changes begin about the capillary tuft in the villi and amyloid spreads by infiltration. Abnormal absorption or excretion, resulting in cell damage, is probably the local determining factor.

After examining in detail the process at work in the various organs, the question arises as to whether the disease has resulted in a degeneration or infiltration. On the one hand, no evidence was found to support the theory that it was a degeneration, for only in the spleen was there any intracellular reaction, and even then, there was no extracellular association of amyloid.

On the other hand, by the application of a solution of barium hydroxide or ammonium hydroxide followed by a solution of barium hydroxide, the amyloid substance was removed, leaving behind atrophic parenchymal cells. Therefore, the microscopic findings obtained by focussing at various levels were confirmed. Treatment of sections by macerating fluids gave similar results. As sections from the various organs in all stages of amyloidosis were examined in the above manner, and as the results were invariably the same, it was concluded that the amyloid process results in an infiltration and not a degeneration.

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There still remain to be considered several other contentions regarding the amyloid process. Some workers have contended that amyloid is conveyed in a soluble state to the organ by the blood stream. Only on rare occasions, in the liver alone, was a connection demonstrable between the amyloid present in the wall of the portal veins and similar collections within the lumen. As already stated, those amyloid collections seen within the lumen of portal veins were the result of a peculiar combination of factors, and even these only locally involved the endothelial and subendothelial layers. In no other organ were there any intravascular amyloid masses.

The general impression therefore suggests that an amyloid precursor does not penetrate from the lumen into the vessel wall and later into the tissues. Nor was there any suggestion of an influence from the blood stream activating the cells of the various organs into complete amyloid production.

Summary.—The main conclusions are that :—

1. The spleen makes a necessary contribution to the whole amyloid process. This product is blood spread as shown by the intravascular masses in the portal veins.
2. The presence of a toxin appears to be essential. Local damage determines the site for deposition in the organ as shown by the amyloid lesions in the chronic nephritic kidney.
3. The amyloid substance is of local manufacture.
4. Amyloid spreads by lymphatics from the original site in the organ.
5. It results in an infiltration.

To Professor Lorrain Smith I am greatly indebted for the advice and assistance he has so generously given me throughout.

This work was done while holding the Hoffmann Fellowship of Queen's University, Kingston, Canada.

REFERENCES.—¹ Davidsohn, W., *Verh. Deut. Path. Gesell.*, 1904 (No. 7), p. 39. ² Davidsohn, W., *Ergebn. d. Wiss. Medezin.*, 1910 (No. 1), p. 330; *Virch. Arch.*, 1907, clxxx., VIII., 395; 1908, cxcii., 245. ³ MacCallum, *A Text-book of Path.*, 2nd ed. ⁴ Wells, *Chem. Path.*, 5th ed. ⁵ Schmidt, *Verh. Deut. Path. Gesell.*, 1904 (No. 7), p. 139. ⁶ Lubarsch, *Ergeb. all. f. Path.*, 1897 (No. 4), 449. ⁷ Weidenreich, *Arch. f. Mikros. Anat.*, 1901, lviii., 247. ⁸ Schafer, *Text-Book Micro. Anat.*, 408. ⁹ Roy, *Journ. Physiol.*, 1881, iii., 203.

OBITUARY

A. H. FREELAND BARBOUR, M.A., B.Sc., M.D., F.R.C.P., LL.D.

WITH the death of Dr A. H. Freeland Barbour, which occurred suddenly while working at his desk on 11th June, there has passed from our midst an outstanding figure in the medical profession. After a broad education in Arts, Science, and Medicine he specialised in Obstetrics and Gynaecology. When still a young man he gained a world-wide reputation through the publication of the *Manual of Gynaecology*, written in collaboration with the late Dr D. Berry Hart. The book is a model for all time in the precision of its language, in the accuracy of its references, in the appreciation of the work of others, and in the restraint of its opinions. It contained no statement not supported by observed facts. It was followed a few years later by the *Atlas of the Anatomy of Labour*, which again exhibited Dr Barbour's painstaking accuracy of observation. It has been the foundation on which much subsequent research in pelvic anatomy and in the physiology of labour has been based. Besides these monumental works he contributed many others of lesser importance but all characterised by the same spirit of painstaking search after truth. All of these remain and through them Dr Barbour's name will always occupy an honoured place in medical literature and medical history.

But to know him only through his scientific work was to know but a very small part of the man. The hundreds of students who passed through his hands in the Extramural School and in the University remember him as a teacher who came to them always fully prepared, who put facts and problems before them in the simplest possible way, who was always ready and willing to discuss difficulties with them, no matter how trivial these might turn out to be, and who would put himself to any trouble to help them not only in their work but in any problem of life which they cared to mention to him. Without being a brilliant lecturer in the accepted meaning of the term, he held the attention of his classes by his transparent sincerity and enthusiasm. He will be remembered by men now scattered in every part of the habitable globe to whom he made Edinburgh a real home during their residence there. Indian, Chinese and Japanese students he took a special interest in. He had the faculty of getting to the root of their mentality in a way which few Westerners have, and he exercised a great influence for good over them in their contacts with our social system. But for Dr Barbour's interest in them and his readiness to receive them in his own home, many would have gone back to their native land without having any idea of British home and family life.

Obituary

As in the individual student, so in the whole complicated organisation which constitutes the Edinburgh Medical School, he took the deepest interest, sparing no pains to help to maintain its great reputation. As a lecturer in and trustee of the New School of Medicine he gave unstinted service to the Extramural School. In the last fifteen years of his active life as lecturer in Gynæcology, and for a time as Professor of Midwifery and Gynæcology, in the University of Edinburgh his counsel in the Faculty of Medicine was invaluable. His pride in his election to the Presidency of the Royal College of Physicians, and his gratification when the University conferred upon him the LL.D. degree, reflected his love for and devotion to these great institutions. That devotion was known to the outer world through his endowment of research in the form of the Freeland Barbour Fellowship of the Royal College of Physicians and the Freeland Barbour Fellowship of the University. His aim was through these to encourage scientific work and so to advance knowledge and enhance the reputation of the Edinburgh School. In the holders of these Fellowships and in the work which they did he took the keenest interest. Many of them, including the writer, owe everything to the inspiration and help given them during this early stage of their careers and subsequently. For not only was he a born investigator, but he had the faculty of inspiring and encouraging others. There can be few who have launched on careers of usefulness so many men as he. His greatest joy was in watching their development. A piece of good work done by them gave him more pleasure than if he had done it himself. His pupils and assistants will always carry with them this memory of their Chief.

The keynote of his whole character was his essential simplicity. It made him the real scientist, concerned only with the basic truth of things, and with the expression of that truth in language clear and direct. It enabled him to take a firm stand on questions of policy, when side issues might seem to pull in another direction. In that way he might temporarily estrange individuals or bodies of men, but it was never for long, because his honesty of purpose and sanity of outlook soon became apparent. It coloured the whole of his private life and that large part of his life which he gave to his fellow men through his numerous charities, to the Church, and to Foreign Missions. All that he thought and all that he did sprang from an inward urge to broaden human knowledge, to simplify life, and to find in life the things that were beautiful and worth while, so that they might be made available to others. His mind was deeply religious and his Faith strong and simple. His was a life fully lived, one which will always remain as a cherished memory and inspiration to all who had the privilege of knowing him.

B. P. W.



Photo by]

A. H. FREELAND BARBOUR

[Beatrice Cundy

PERISCOPE

DRAINAGE AS A FACTOR IN RENAL DISEASE.

In reviewing a series of 2500 patients in whom a diagnosis of ureteral stricture had been arrived at after careful investigation, the author feels convinced that in the past the importance of drainage as a factor in renal disease has not received sufficient attention. The pioneer work of Kelly in 1902 is emphasised in relation to stricture of the ureter being in many instances the primary cause of hydronephrosis and pyonephrosis. In 90 per cent. of the author's cases of hydronephrosis and chronic infections of the kidney pelvis, the presence of ureteral stricture was established. The recognition of ureteral stricture has frequently been overlooked due to the prevailing impression that if an ordinary renal catheter passes up easily to the kidney there can be no organic disease of the ureteral walls capable of causing urinary stasis. Similarly, by wrong interpretation of pyelo-ureterograms, the lesser deformities have been missed and only the gross lesions noted.

In hydronephrosis the degree and location of the ureteral stricture vary, and the secondary changes due to the lesion are not constant. A stricture at the vesical end may give rise in some cases to a dilatation of the renal pelvis as well as the entire length of the ureter proximal to the stricture, whereas in others the dilatation may have occurred chiefly in the calyces at the expense of the renal cortex. Due to the variable nature of the secondary changes in affecting the symptomatology and degree of renal impairment, it is essential that in all cases careful radiographic and functional studies be made of both sides.

In the group of chronic infections of the kidney pelvis, embracing pyelitis, infected hydronephrosis and pyonephrosis, stress is laid on the recognition of urinary stasis, and the correction of this is an essential step in the treatment. Having been impressed by the rôle which stricture plays in these chronic conditions, the author now routinely investigates for the presence of this predisposing factor, and by correcting it obtains far more encouraging results than previously. In the treatment of chronic pyelitis during the last few years ureteral dilatation has proved more efficacious than the accepted routine of pelvic lavage with varying antiseptics.

In patients with symptoms suggestive of a urinary tract lesion, 80 per cent. showed a urine that was normal or approximately so, yet in spite of this apparently negative finding, complete investigation revealed the presence of ureteral stricture for which appropriate treatment gave relief. It is in this type of case that unnecessary operations, rest cures, gastro-intestinal and other forms of medical treatment have been so frequently resorted to without benefit.

The author is of opinion that the primary seat of stricture is in the

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lower portion of the ureter, and that changes in the upper ureter are secondary and probably due to urinary stasis plus infection. Though the majority of cases are cleared up by correcting the primary lower stricture, a few fail to respond, and in these the upper ureter requires attention. The author has found that renal and ureteral calculi are associated with stricture of the ureter in 90 per cent. of his cases. At the same time it is pointed out that calculus formation has been observed in only one-twelfth of all his stricture cases, a strong indication that factors other than stricture and stasis play an important part in stone formation. While stricture is practically always bilateral, the incidence of bilateral calculus is not nearly as high as we would anticipate. Clinical experience in this field has led to the following conclusions: "(a) The presence of a calculus in the kidney or ureter is presumptive evidence of a coexistent ureteral stricture. (b) Ureteral stricture is probably of blood-borne origin, hence as one would anticipate under such circumstances we find it is practically always bilateral. (c) The symptoms and many of the pathological changes which we formerly ascribed to the presence of a stone are probably more often due to the stricture." By the early diagnosis and treatment of ureteral stricture, including the eradication of the causative focal infection, the incidence of stone formation might possibly be greatly reduced.

In the group of "essential hæmaturias" the possibility of ureteral stricture should not be overlooked. Its detection and correction in several cases has given rise to complete relief.

Reference is also made to cases of multiple abortion due to renal insufficiency. Investigation has disclosed in many of these cases that the condition was apparently due to ureteral stricture, and that after the establishment of good ureteral drainage the general health and renal function improved so much that the women were able to go to term and were delivered of healthy children.

In conclusion a suggestion is put forward that many of the renal diseases usually considered as purely medical may in part be due to defective drainage.

GUY L. HUNNER, "Drainage as a Factor in Renal Disease"

(*Surg. Gynec. and Obstet.*, 1926, xliii., No. 5, 615-626).

D. M. M.

THE ETIOLOGY OF PEPTIC ULCERS.

In an experimental investigation into the causation of peptic ulceration of the stomach and duodenum, Morton has commenced by repeating and confirming the work of Mann and Williamson on the results of the operation of "surgical duodenal drainage" when performed on dogs. This operation consists of (1) division of the pylorus and closure of the duodenal stump; (2) division of the duodeno-jejunal flexure and end-to-end anastomosis of the jejunum to the pyloric stump of the stomach in order to reconstitute the continuity of the

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intestinal canal, etc.; and (3) closure of the lower end of the duodenum and side-to-side anastomosis of this portion of bowel to the lower end of the ileum.

The operation results in all the duodenal secretions being diverted into the lower reaches of the ileum and a failure of the normal neutralisation of the gastric juice during digestion. Results similar to those obtained by Mann and Williamson are reported, that is to say, in all cases typical chronic or subacute post-pyloric ulcers developed. The ulcers corresponded exactly to the peptic ulcers seen in man, and many of them eventually progressed to perforation.

The author then proceeded to test the effect of this operation on the healing of acute traumatic ulcers of the stomach. In a series of normal controls, ulcers produced by excising areas of mucous membrane in the stomach were found to heal rapidly without exception. In animals subjected at the same time to "surgical duodenal drainage," these acute ulcers healed more slowly than in the normal animal when they had been produced along the greater curvature of the stomach, while those which had been produced in the "ulcer-bearing" area of the organ developed into typical chronic peptic ulcers in some 50 to 60 per cent. of cases.

Lastly, after producing post-pyloric ulcers by "surgical duodenal drainage" the author has watched the effect upon them of a gastro-enterostomy without closure of the pylorus. This led in all cases to healing of the post-pyloric ulcers and to the development of fresh ulceration at the site of anastomosis.

Morton therefore concludes that the "acid-alkali imbalance" following "surgical duodenal drainage," and the force with which the gastric contents impinge directly upon a relatively circumscribed area of intestinal wall, have an important bearing on the development of chronic ulceration after the operation. The same factors probably have a bearing on the etiology and treatment of chronic peptic ulceration in man.

CHARLES BRUCE MORTON, "Observations on Peptic Ulcer. 1. A method of producing chronic gastric ulcer. A consideration of etiology." (*Annals of Surg.*, Feb. 1927, 410. Pp. 207-238.)
D. S. M.

NEUROMUSCULAR DYSFUNCTION OF THE BLADDER AS A CAUSE OF PYELITIS IN CHILDHOOD.

The author adopts the suggestion of Braasch and subdivides these cases into two groups: (1) the "cord" bladder, because it is associated with definite disease of the spinal cord; (2) the "atonic" bladder, so called because of a flabby musculature and diminished expulsive power (where lesion is probably in plexus or nerves of bladder).

In the Mayo clinic in five years, fifteen cases of neuromuscular dysfunction of the bladder were observed in children, whose ages

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varied from 1 week to 14 years. Six cases were in boys, while nine were in girls. Symptoms in most cases existed from birth, although in three of the cases the symptoms first came on at 5 years, 5 years, and 12 years respectively.

Of these fifteen cases, ten were cases of "cord" bladder, while five were cases of "atonic" bladder. The most common complaints were incontinence and frequency. Seven of the cases had no urinary control whatever, six were troubled with frequency, one complained of difficult micturition and one of enuresis.

In most cases the bladder could only be incompletely emptied by voluntary effort of abdominal muscles. The residual urine varied in amount from 20 to 480 c.c. All cases except one had had attacks of fever, with definite pyuria. In eight cases the bladder was palpable suprapubically, and disappeared on catheterisation. The infecting organism in twelve cases examined was *B. coli*, in nine cases, *B. proteus*, *B. capsulatus*, *mucosus* and *staphylococcus* in one case each.

Radiograms of the kidneys, ureters and bladder showed nothing abnormal in these organs, but spina bifida occulta was found in six cases, while in three others there was marked deformity of the sacrum and coccyx. In "cord" bladder cystoscopy revealed trabeculation and hypertrophy as well as relaxation of the internal sphincter.

Treatment in these conditions is difficult and the results poor, as the kidneys become infected sooner or later. The measures adopted are drainage of the bladder at regular intervals to prevent excess of accumulation of urine, flushing out of urinary passages and the administration of methanamine with ammonium chloride, in addition to forcing fluids. This diminishes the amount of the pus but does not clear it up. Surgically there is little to do.

H. F. HELMHOLTZ, Rochester, Minn. (*American Journal of Diseases of Children*, 1926, xxxii., 682).

A. J. C. H.

CONTRIBUTION TO THE STUDY OF MESENTERIC CYSTS.

Numerous classifications have been suggested for this condition, some according to clinical findings, others based on anatomical and pathological features. The author adopts both methods. Clinically, he divides them into: *A. Retroperitoneal cysts*; *B. true mesenteric cysts*. From the pathological standpoint he places them in seven groups, as follows: *A. Retention Cysts*.—These are chiefly due to occlusion of the lymphatics by inflammation, and there results a large multilocular cyst always lined by endothelium. *B. Degenerative Cysts*.—In certain cases the infection appears to affect the vessels passing from the mesenteric glands with resulting obstruction and distension of the glands which become converted into unilocular cysts containing in their

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walls remnants of lymphoid tissue. *C. Lymphangiomas.*—These differ in that they consist of cavernous spaces lined by proliferating endothelium and contain fluid which may be serous, chylous, purulent or hæmorrhagic. The latter must be differentiated from an encysted hæmatoma of the mesentery, which is not a true cyst. *D. Congenital Cysts* are those arising from embryonic rests in the retroperitoneal tissue which may invade the mesentery secondarily. Their contents are serous and they may attain a great size. *E. Dermoid Cysts.*—In this group are included cysts derived from all three layers of the developing embryo, of the teratoid type. *F. Intestinal Cysts.*—These arise from separated portions of the primitive intestine which degenerate to form mesenteric cysts. *G. Parasitic Cysts.*

In a series of 72 cases of mesenteric cysts reported in the literature, 53 occurred in females and 19 in males. The cysts may be single or multiple, sessile or pedunculated, and they are most commonly met with in the mesentery of the ileum. They vary greatly in size and may contain as much as four or five litres of fluid. As a rule the cyst is attached to the posterior layer of the mesentery, but as they distend, adhesions form between the cyst and the anterior layer. The cyst usually possesses a neuro-vascular pedicle and there may be large distended vessels spread over the cyst wall. Retroperitoneal cysts and true cysts of the mesocolon generally push the loop of bowel in front of them and these cysts are therefore surmounted by a loop of bowel. In case of cysts in the mesentery of the small intestine the loops of bowel tend to surround the cyst.

The author describes two cases which he treated successfully and discusses the symptoms which such cysts tend to produce. The patient at first complains of somewhat vague symptoms, loss of appetite, "indigestion," and diarrhoea, followed by constipation. These symptoms may persist for long periods and then suddenly symptoms of obstruction, usually subacute, supervene. In the case of retroperitoneal cysts this has been shown to be due to the bowel, usually colon, being compressed against the abdominal wall, while in the case of true mesenteric cysts the occurrence of volvulus frequently accounts for the urgent symptoms. Owing to the tendency to obstruction, marked abdominal distension is a common finding. During the subacute attacks there is well-marked abdominal rigidity, though at operation it is rare to find any evidence of peritoneal infection. Findings on percussion will vary according to the type of cyst. In the retroperitoneal type, it has been seen that the cyst is surmounted by a loop of bowel and therefore it is common to find a resonant band across the area of the cystic swelling. Mesenteric cysts are more freely movable than those situated behind the peritoneum and they are usually smooth and oval in shape.

As regards treatment, the author considers that operation is

Periscope

indicated, and, unless the cyst is very large, is not fraught with difficulty. Usually adhesions are not of much importance, but in some cases it may be necessary to resect a loop of adjacent bowel owing to interference with the vascular supply to the part during the removal of the cyst.

M. CORNIOLEY (*Lyon Chirurgica*, September-October 1926).

K. P. B.

IDIOPATHIC NARCOLEPSY.

This disease is characterised by the occurrence of attacks of irresistible sleep without apparent cause and curious attacks of emotion in which the muscles relax suddenly, so that the victim sinks to the ground fully conscious but unable to move. As a rule the attacks occur independently; occasionally an attack of emotion ends in sleep. These are referred to as "sleep attacks" and "cataplexy." The author records five cases of his own, fifteen from the literature and states that about 40 cases in all have been published. The disease is distinct from epilepsy, pyknolepsy, hysteria and "lachoehlag."

According to Pavlov, sleep is internal inhibition. He found that animals in which he had created conditional reflexes could have such conditional reflexes inhibited under certain conditions, and that every more or less prolonged stimulus to the cortex whatever its nature and however strong it may be, if it is not accompanied by stimuli to other parts, or if not displaced by other stimuli, leads inevitably to somnolence and sleep. An animal will look towards a sound; if repeated at frequent intervals the reflex diminishes steadily until it disappears, if the sound be continued the animal ultimately becomes somnolent or falls asleep. Sleep and internal inhibition are thus one and the same process. The author considers that these observations of Pavlov all have their counterpart in narcolepsy—the tendency to sleep when the stimuli are monotonous or few, the transitions from cataplexy to sleep, the ease with which the patient is awakened by a fresh stimulus and the immediate and complete wakefulness of a patient so awakened. True narcolepsy is a functional disorder of the nervous system, probably an undue fatigability of nerve cells, in individuals with a peculiar kind of nervous activity which allows excessive responses and favours the spread of inhibitions. Sleep and cataplexy may follow encephalitis lethargica and constitute a symptomatic narcolepsy. The centre from which this general inhibitory action is exerted lies in the 'tween brain, and thus is sub-cortical, which with the pituitary and adjacent vegetative centres forms an endocrine-nervous system; narcolepsy is primarily a disorder of this system.

W. J. ADIE, "Idiopathic Narcolepsy: a Disease *sui generis*; with Remarks on the Mechanism of Sleep" (*Brain*, 1926, xlix., 257-306).

N. B.

TUBERCULOUS STRICTURE OF THE CARDIA WITH ŒSOPHAGEAL DILATATION.

The case is reported fully because of the rarity of the condition and the similarity of the symptoms to cardiospasm.

A man, aged 55, gave a history of vomiting in the evening for twenty-four years. For a period of ten years he had vomited every evening when he lay down, and it appeared as if the stomach overflowed its contents. Relief for one year was obtained after the passage of an œsophageal bougie which met with resistance at the lower end of the œsophagus. Thereafter, vomiting returned in intermittent attacks, and, in addition, the general health of the patient began to fail. On examination pain in the chest with fever indicated some mediastinitis and the œsophagus could be percussed out after food was taken. To be retained, food in very fluid form had to be given.

Radiographically a very dilated œsophagus was seen, ending in a stricture below the level of the diaphragm. The walls of the œsophagus at the lower end of the dilated portion were irregular.

At operation retrograde dilatation of the stricture failed, and subsequently the lower end of the œsophagus and fundus of the stomach were freed and examined, and after gastrostomy, an annular fibrous stricture of the œsophagus was divided. This operation relieved symptoms for a year, but thereafter dysphagia recurred, and, coincidentally, mediastinitis. Œsophago-gastrostomy was to be done, but the presence of a yellowish nodule in the liver, with ascites, led to a diagnosis of carcinoma, and the operation was abandoned.

At autopsy the œsophagus was found dilated for 34 cm. with a diameter of 12 cm. At the lower end a stricture extending for 6 cm. above the cardiac orifice was found. The walls were thickened and scattered nodules were felt in their substance. Posteriorly two large glands with necrotic centres were present—similar glands at the hilum of the liver and a nodule in its substance as noted at operation were found.

On microscopical examination the œsophageal wall, glands, and liver nodule were all noted to be typically of tuberculous nature, with giant-cell formation and epithelioids.

The long history, situation of the lesion, and radiographic appearances suggested cardiospasm, and it is suggested that perhaps an organic basis for such œsophageal dilatation may be present more often than is generally supposed.

- A. G. LUNDGREN, "Dilatation œsophagienne provenant d'un rétrécissement tuberculeux du cardia" (*Acta Chirurgica Scandinavica*, lxi. (ii-iii.), 172).
D. B.

NEW BOOKS

The Principles of Pathology. By CHARLES POWELL WHITE, M.D., F.R.C.S. Pp. x+279, with 14 illustrations. Manchester: University Press. 1927. Price 15s. 6d.

Dr Powell White's book has the merit of being something out of the ordinary. It is not a text-book, but is, as the author states, designed to supplement the text-books. In preparation for examinations it will be of small use. ~~Therefore it is to be feared, among under-~~ graduates it will appeal only to those rare spirits who seek knowledge ~~for its own sake.~~ Its appeal will be to those who are already familiar with pathological processes. The beginner will find much of it beyond his understanding.

The author claims for pathology a place, and an important place, as a part of the science of biology. The book is an attempt to establish that claim and to show that the principles of pathology are those of biology applied to the abnormal conditions produced by disease. Considerable space is devoted to classification and a praiseworthy effort is made to reduce to a semblance of order the chaos of pathological nomenclature and classification. It may be doubted, however, whether all the classifications suggested do really serve any such purpose.

The author's views are not likely to meet with universal approval. He advances them as an expression of personal opinion, and they richly merit careful and critical consideration. The book is interesting and thought-provoking and ought to be widely read. Particularly is it to be commended to those who are prone to regard pathology as a mere adjunct to clinical medicine and to deny to it any right to a place among the biological sciences. It will give them cause to reflect.

Bacteriological Atlas. By RICHARD MUIR. Pp. 134, with 60 coloured plates. Edinburgh: E. & S. Livingstone. 1927. Price 15s.

This admirable publication deserves to gain wide popularity among all students of bacteriology, graduate and undergraduate. Mr Muir is a medical artist of high distinction. He has had long and large experience of the needs of students, and to the many who have come into personal touch with him his name will be sufficient guarantee of the quality and usefulness of his book.

The Atlas consists of sixty coloured plates representing a large variety of pathogenic bacteria and certain animal and vegetable parasites, as seen under the microscope when stained by methods commonly employed. Opposite each plate a short descriptive note is

New Books

provided indicating the morphological characters. If used as is intended in conjunction with a text-book or practical manual, or during a course in practical bacteriology, the Atlas will be of great service in aiding students to familiarise themselves with the microscopic appearances of pathogenic micro-organisms. The plates are artistically depicted and excellently reproduced. Both author and publishers are to be congratulated upon a notable achievement.

Röntgen Rays in Dermatology. By L. ARZT and H. FUHS, Vienna.
Translated from German by C. Kelvin O'Malley. Pp. xiv + 202,
with 62 illustrations. London: Ballière, Tindall & Cox. 1927.
Price 18s.

This volume treats the subject in the usual thorough German method. It begins with the physics of X-rays, a description of apparatus, dosage, and methods of treatment. The biological effects of X-rays and X-ray injuries, including their medico-legal aspects, are then discussed. The latter part of the book is devoted to the treatment of individual diseases of skin, hair, and nails.

The methods described are very much the same as those in use in this country. The book is not too long and everything in it is stated in a straightforward logical manner. We can thoroughly recommend it to the dermatologist and radiologist. It will be useful both to the beginner as a complete guide to the subject and to the experienced as a book of reference. The authors describe the apparatus and routine which has been found best at the Riehl Clinic, Vienna, and do not confuse one with too many alternatives. The illustrations are good and the numerous diagrams are clear and helpful.

As a book of this kind is difficult to translate, owing to the number of technical terms employed, we congratulate the translator on the way in which he has done his work.

Human Pathology. By HOWARD T. KARSNER, M.D. Pp. x + 980,
with 463 illustrations. London: J. B. Lippincott Company.
1927. Price 45s.

All students and all teachers of pathology would welcome with enthusiasm the arrival of a perfect text-book on that subject; but the perfect text-book is not yet. Indeed it may be doubted if it ever will arrive, or if unanimity will ever be reached as to what constitutes perfection. Certainly in such a subject as pathology, to achieve the perfect text-book lies surely beyond the powers of any one author. Nevertheless, Professor Karsner has produced a good book on morbid anatomy and pathological histology. It is divided according to the conventional plan into two sections, dealing respectively with general

New Editions

and systemic pathology, an arrangement which is probably, as the author claims, the most suitable to meet the needs of students of medicine. It is copiously illustrated, and many of the illustrations are excellent. The lists of references to the literature which are provided at the end of each chapter are full and ought to be found helpful, especially as preference has been given to publications in the English language.

The publishers' share in the production, as regards both text and illustrations, is well done. The book, however, shares with many another text-book of pathology the drawbacks of excessive weight, which makes it impossible to hold it in the hands with any degree of comfort, and of a high price, which will not commend it to students possessed of purses often none too long.

This work will certainly take its place among the best standard text-books of pathology. Yet we are doubtful whether there is real need, or indeed room, for another such book which is neither greatly different from, nor obviously better than, several others which are already in the field.

NEW EDITIONS

Manual of Bacteriology. By MUIR and RITCHIE. Eighth Edition. Pp. xxiv+821, with 211 illustrations and six coloured plates. London: Humphrey Milford. 1927. Price 16s.

The eighth edition of this very useful student's handbook on Bacteriology has been revised, and to some extent rewritten, with the collaboration of Professor C. H. Browning and Professor T. J. Mackie. The new edition is a great improvement on the previous edition for the appendices of the seventh edition have been incorporated in the text of the eighth. A number of chapters have been rearranged. The chapter on Bacteria in Air, Soil, Water and Milk—Antiseptics, chapter v. of the seventh edition, for example, is now placed at the end of the volume in an appendix, while the chapter on Immunity, xxii. of the seventh edition, is chapter vi. of the new edition. Both these chapters have been rewritten.

A number of subjects which were not referred to in previous editions are discussed, to mention only a few, Bacteriophage, Infectious Coryza, Tularemia and Epizootic Abortion. Several new chapters have been added. The subject of Plague and Tularemia, for example, are discussed in one chapter; Malta Fever and Epizootic Abortion are dealt with in another; while Epidemic Influenza, Infectious Coryza and Whooping Cough are considered in a third. These very distinct groups of subjects were discussed in a single chapter in former editions.

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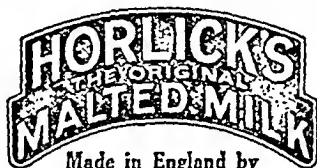
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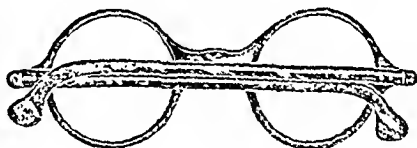
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New Editions

Enough has been said to show that the eighth edition has been remodelled, and that additional subjects have been added, yet the book has not been enlarged to a greater extent than by the addition of sixty-eight pages. This desirable quality for a student's handbook has been effected by condensing subjects of less importance and by the judicious use of smaller type when necessary. A number of new illustrations have been added while certain others have been discarded. Mention should be made of the fact that the nomenclature and classification of the Society of American Bacteriologists has been adopted tentatively in this edition.

It is certain that this new edition will continue to fulfil efficiently the purpose for which it has been written, namely, a useful introduction to the study of Bacteriology for Medical Students.

Compendium of Regional Diagnosis in Affections of the Brain and Spinal Cord. By ROBERT BING of Basle. Translated from the sixth German Edition, by F. S. Arnold, B.A., M.B., Ch.B. Third Edition. Pp. xv+204, with 102 illustrations. London: Wm. Heinemann, Ltd. 1927. Price 15s.

"Regional diagnosis" is concerned with the exact anatomical localisation of a circumscribed lesion of the central nervous system as deduced from a combination of irritative and paralytic symptoms caused by the injury to, or destruction of, separate structures of the nervous system. It is thus simply the application of anatomy and physiology to clinical symptoms. It is obviously of vital importance where surgical interference is contemplated, but it is equally of importance in determining prognosis, as the situation of the lesion is just as significant as its pathological nature.

This volume stands out pre-eminently among books devoted to this branch of neurology. The subject matter is divided into two parts, the first dealing with regional diagnosis of lesions of the spinal cord, and the second with regional diagnosis of brain lesions. When compared with the first edition which appeared in 1909, it illustrates how extensive has been the increase in our knowledge of spinal and cerebral localisation since that date. Special attention has been directed towards the incorporation of advances in knowledge resulting from the enormous field of study of organic lesions caused by the recent war. One of the most valuable features, however, is the thorough revision which the illustrations have undergone, and which adds greatly to the value of the book. The complexity and difficulties which localisation of function in the central nervous system presents to the investigator is clearly shown here, and it is remarkable how many phenomena are recorded for which no satisfactory explanation has yet been offered.

Notes on Books

Lecithin and Allied Substances: The Lipins. By HUGH MACLEAN, M.D., and I. S. MACLEAN, F.I.C. Second Edition. Pp. 220. London: Longmans, Green & Co. 1927. Price 10s. 6d.

The "fat like" bodies play a very important part in the body economy. They are for the most part highly complex substances difficult to separate and to obtain in a pure state. This difficulty is illustrated in the history of the substance Protagon long believed to be a pure substance and now recognised as a mixture of various lipins. The authors deal critically with the literature of this class of organic substances, and in their last chapter introduce some interesting suggestions as to the biological significance of the group. This monograph worthily maintains the high standard of excellence shown by the other members of the series issued under the general editorship of Dr R. H. A. Plimmer and Sir F. G. Hopkins.

NOTES ON BOOKS

Diseases of Women by H. S. Crossen, M.D., F.A.C.S., Sixth edition (Kimpton, 50s.), is more than an ordinary text-book, and it is written in a very practical manner which impresses the reader with the vast clinical experience which underlies the writing. Probably the outstanding chapter is that on "Pelvic infections, both acute and chronic." This is admirably written and gives one of the best presentations of this difficult subject to be found in any single volume on the Diseases of Women. The clinical manner in which it is written is both impressive and attractive. The recent advances in the diagnosis and treatment of sterility are described, with special reference to the inflation of the Fallopian tubes and to the use of lipiodol. In regard to the treatment of carcinoma of the cervix the discussion of the radium and operative procedures well repays the study. Here Dr Crossen favours the routine insertion of radium into the uterus prior to operative interference, even in the early cases. This is in general agreement with the present day practice of British gynaecologists. Several pages are allotted to the use and description of pessaries of various kinds; to some this may seem unnecessary, but there are few discussions on pessary treatment so detailed as the one here presented. The illustrations are beautifully reproduced. We have no hesitation in commending the book.

The following books are issued by Mr Humphrey Milford, Oxford University Press :—

Notes on Books

The Treatment of the Acute Abdomen, by Zachary Cope (10s. 6d.). As we should expect in a companion volume to *The Early Diagnosis of the Acute Abdomen*, the book contains a wealth of sound practical advice couched in plain, clear language and accompanied by lucid diagrams. We cannot remember having read anything which gives a more faithful representation of the author's technique than the chapter on appendicitis does of Mr Cope's logical and efficient methods in this disease.

The sixth edition of *A Manual of Operative Surgery*, by Sir Holburt J. Waring (18s.), has been generally revised and slightly enlarged. In addition to the insertion of several operations not previously included, a chapter has been devoted to operations upon the hypophysis cerebri, and Mr Geoffrey Keynes contributes a section on blood transfusion. About forty new illustrations have also been added. This volume is, as in previous editions, a comprehensive and valuable treatise on operative surgery.

The third edition of Dr A. S. Woodwark's *Manual of Medicine* (15s.) should make an excellent *vade-mecum* for the student preparing for examination. The work is arranged in the system, so popular of recent times, of giving information briefly and to the point with occasional explanatory paragraphs, excellent for quick reference but scarcely aiding reasoned understanding. The work is cleverly written, and contains a large mass of varied information; the sections devoted to diseases of the nervous system and acute specific fevers are worthy of special note, while a chapter on insanity is included with advantage.

Compression of the Lung in the Treatment of Pulmonary Lesions, by Stuart Tidey (3s. 6d.). Working on the theory that relaxation of the peripheral pull on diseased areas is the element essential to the healing of pulmonary lesions, the author causes compression of the lower part of the thorax by applying adhesive strapping. The repetitions detract from an otherwise excellent little monograph.

We have received the following books from Messrs Baillière, Tindall & Cox:—

Urinary Surgery, by W. R. Irwin, M.D., F.R.C.S.E. (10s. 6d.). Previously designated *An Introduction to Surgical Urology*, the second edition of this work retains its original arrangement. It has, however, been amplified in such a way as considerably to enhance its value as a sound, practical and concise treatise for the use of senior students and practitioners. Instead of utilising a regional classification, the chief symptoms, such as hæmaturia, frequency of micturition or urological pain, are dealt with in separate chapters wherein their causation, differential diagnosis and treatment are discussed. Four new chapters have been added giving the essential steps of the main operations employed for the treatment of lesions of the whole urinary tract.

Notes on Books

Tuberculosis of the Lungs, by H. Hyslop Thomson and A. P. Ford (10s. 6d.) has been written especially for the guidance of general practitioners and deals with the subject from a clinical point of view. Non-essential methods and those which cannot conveniently be carried out at the bedside are excluded. Rest, graduated exercise and prolonged treatment are the cardinal points in treatment which are stressed. The subsidiary details and symptomatic treatment are described at sufficient length to be of value. Artificial pneumothorax is strongly advocated in selected cases. We can recommend this book as a useful addition to the already extensive library on pulmonary tuberculosis.

Ship Surgeon's Handbook, by A. V. Elder, D.S.C., M.R.C.S., L.R.C.P. (10s. 6d.). This third and much enlarged edition fully justifies its title. Anyone purposing to undertake medical duties at sea will be well advised to study it before embarking, as it is full of most useful advice as to choice of equipment, etc., and discusses the many difficulties that may arise as to the doctor's status and duties, ship etiquette, and medical practice at sea. The most recent regulations, also, as to emigrant service are carefully and clearly detailed.

Lessons on Massage, by Miss Margaret D. Palmer (10s. 6d.), was first published in 1901 and now appears in its sixth edition. The book is now arranged in two parts. The first consists of massage lessons rewritten by Miss Dorothy Wood, the second of notes on anatomy. The chapters on theory of massage, treatment of fractures and deformities, contain good material. Those on diseases of the circulatory and respiratory systems are not sufficiently detailed and classified, while those on digestion and circulation are more comprehensive. The lessons on anatomy though brief are clear and the illustrations good. As a handbook for students it can be recommended.

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Examination of the Patient and Symptomatic Diagnosis, by John Watts Murray, M.D. (Kimpton 36s.) makes no claim to present new facts, but to present a large number of established facts in a condensed and helpful form. It is open to doubt whether the end aimed at has been achieved. A symptom is mentioned and is usually followed by a list of the conditions which may give rise to it. Some of these lists consist of fifty or more diverse diseased conditions calculated rather to bewilder than to enlighten the student. There is not sufficient discrimination between the rarer and the commoner diseases and we feel that as a practical aid to symptomatic diagnosis the book has little value. The index is quite inadequate for a work of this kind.

Notes on Books

A Synopsis of Hygiene, by W. W. Jameson and F. T. Marchant (Churchill, 18s.). Although it now attains its 500th page, is still an invaluable mine of well-arranged, reliable, concise information not readily available elsewhere; and is thus a great friend to the hard-pressed student. When the next edition marks the inevitable evolution into a full-blown, voluminous text-book, one may hope that the authors may earn their halos even more certainly by bringing out simultaneously a "Synopsis of Hygiene" of not a single page more than 250.

The aim of the author of *Treatment of Venereal Disease in General Practice*, by E. T. Burke, D.S.O., M.B. (Faber & Gwyer, 5s.). is "to present in a brief and clear manner a scheme for the routine treatment of venereal diseases such as can be carried out by the general practitioner," and this objective has been successfully attained. It is apparent, however, that some of Dr Burke's expressed opinions are at least open to controversy, as are also some of the practical methods in treatment which he advocates. Nevertheless the book is brightly written and eminently readable: the "Obiter Dicta Syphilitica et Gonorrhoeica" in particular convey much valuable information compressed in tabloid form.

Studies of Cholera in Japan, by Rokuro Takano, Itsuya Ohtsubo, and Zenjuro Inouye (League of Nations: Health Organisation). On the invitation of the Health Organisation of the League of Nations the authors undertook this work. They believe that they have summarised all the more important contributions to the subject, although the amount of published work in Japan is enormous. By far the greater part of the literature is in Japanese, and, therefore, inaccessible to most Western investigators. The book is a useful addition to the literature of Cholera, as it gives, for the first time, in the English language, a complete review of the Japanese work on the subject.

Loss of Hair and its Treatment by Light, by F. Nagelschmidt (Sollux Publishing Company). This method of treatment is now well established. The mercury vapour lamp is preferred as the source of ultra-violet radiation. The experiences of others during past years are in line with the results recorded in this book.

The purpose of *The Specialties in General Practice*, compiled by Francis W. Palfrey (Saunders, 3cs.), is to provide the general practitioner in one volume with information which he would require to search for in books dealing with different specialties. In view of the fact that "the total of medical knowledge has become so much that it is beyond the capacity of any one man to have a complete command of the whole in all its branches," it is necessary to provide for the limited knowledge of specialties which every young practitioner must have. The idea is well carried out. The articles are written by specialists on their

Notes on Books

subjects, all of them belonging to the Harvard School. This volume meets a real want in the life of busy doctors, and it is put together in a business-like, practical way which adds considerably to its value.

The Heart and its Diseases, by Charles W. Chapman, M.D., M.R.C.P. (E. & S. Livingstone, 8s. 6d.). This addition to the many small handbooks on the heart which have recently appeared is addressed to students and practitioners. The book is divided into twenty-three chapters dealing with the clinical and instrumental examination of the heart and with the various diseased conditions to which it is liable. Such problems are discussed as marriage and maternity and the administration of anæsthetics in relation to heart disease. Some very good and useful descriptions of the causation, diagnosis and treatment of certain forms of disease are given, but in other cases the picture given is too sketchy to be of much practical value.

Good Health and Happiness, by J. Ellis Barker (Murray, 7s. 6d.). The writer's thesis is that 90 per cent. of our ailments are caused by faulty methods of living, particularly by injudicious diet. In so far as the book draws attention to the need for more complete knowledge and practice of common-sense personal hygiene on the part both of doctors and of laymen, it can do nothing but good. It may be thought that the picture of the average individual's state of health is somewhat overdrawn, but the author is obviously impressed by the public's need of such teaching as he has to give.

BOOKS ON NURSING.—We have received the seventh edition of Mr J. R. Watson's *Handbook for Nurses* (Faber & Gwyer), which is an excellent book to put into the hands of a nurse beginning her training. Mr Russell Howard's *Surgical Nursing* (Arnold, 7s. 6d.), which has reached its fifth edition, reflects the teaching of the London Hospital School of Nursing in a clear and systematic manner. *Practical Nursing* (Ball, 4s. 6d.) has been prepared for male nurses in the R.A.M.C. and other forces, by Col. E. M. Hassard, A.M.S., and A. R. Hassard. The second edition, now before us, abundantly fulfils its purpose.

Minor Surgery and Bandaging, by Gwynne Williams, M.S., F.R.C.S. (J. & A. Churchill, 10s. 6d.) is now in its nineteenth edition since it was issued in 1861, by the late Mr Christopher Heath to be a guide, councillor, and friend to house surgeons and senior students, and it has served its purpose well. The present editor—Mr Gwynne Williams—has admirably fulfilled the original purpose and spirit of Mr Heath's first edition. The instructions are explicit and are evidently based on wide knowledge and practical experience. In the chapter on Fractures we note that Seyer's method of treating fracture of the clavicle is figured and described, but it seems doubtful if this method is still worthy of being considered satisfactory.

Notes

Anabolin, Detoxication and Hypertension, by Henry R. Harrower, M.D. (Baillière, Tindall & Cox, 10s. 6d.), resolves itself into an attempt to justify the claims put forward on behalf of a liver extract marketed under the name of Anabolin. A good deal of work has recently been done to prove that the liver is an organ of internal secretion from which an active vaso-depressor substance can be isolated. Harrower reviews this work critically, and contrasts his own preparation with those of others. Liver extracts are liable to contain quantities of peptone, histamine, and choline, which might account for vaso-dilatation, but Harrower claims that anabolin has been freed from choline and peptone and contains only negligible traces of histamine, and it is indeed a true endocrine depressor. For the most part the subject is examined scientifically and critically, but every here and there loosely supported claims are repeated. Repetitions are frequent and the matter is written in a manner more egotistical than is usual in such works. A chapter devoted to clinical records of illustrative cases ends with these words—"The conclusion is justifiable that the aggregate impression of several thousand physicians for nearly eighteen months, based on over 100,000 injections as well as the administration of tablets almost innumerable, is a fair index of the activity of, and therapeutic prospects of, this remedy. When to this admittedly semi-scientific data are added the laboratory reports, and the extensive work done by numerous workers with other hepatic depressor extracts quite similar to Anabolin, it is hard to escape making a conclusion in favour of this new endocrine remedy."

NOTES

At a Special Graduation Ceremonial held in the M'Ewan Hall on Wednesday, 20th July 1927, the Chancellor of the University—The Earl of Balfour—conferred the Honorary Degree of *Doctor of Laws* on the following: Vittorio Ascoli, Professor of Clinical Medicine, Rome; Harvey Cushing, Professor of Surgery, Harvard University; Charles L. Dana, Professor of Neurology, Cornell University; The Right Hon. Lord Dawson of Penn, G.C.V.O., K.C.B., etc.; Archibald Donald, M.A., M.D., Ch.M., F.R.C.P., Emeritus Professor of Clinical Obstetrics and Gynæcology, University of Manchester; Charles Edward Douglas, M.D., Cupar; Knud Faber, Professor of Clinical Medicine, Copenhagen; Sir William Hale-White, K.B.E., M.D., F.R.C.P., Physician to Guy's Hospital; Jan van der Hoeve, Professor of Ophthalmology, Leyden; Robert George Hogarth, C.B.E.,

Notes

F.R.C.S., Nottingham; William Hunter, C.B., M.D., C.M., F.R.C.P., Physician to Charing Cross Hospital; Otto Meyerhof, Kaiser Wilhelm Institute of Biology, Berlin; Thomas Hugh Milroy, M.D., Professor of Physiology, Queen's University, Belfast; Sir Berkeley George Andrew Moynihan, Bart., K.C.M.G., C.B., F.R.C.S., Leeds; Otto Naegeli, Professor of Medicine, Zürich (*in absentia*); Sir John Herbert Parsons, C.B.E., F.R.S., D.Sc., F.R.C.S., Ophthalmic Surgeon to University College Hospital; Sir Humphry Davy Rolleston, Bart., K.C.B., M.D., Regius Professor of Medicine, Cambridge; George Frederic Still, M.A., M.D., F.R.C.P., Professor of Diseases of Children, King's College, London; William Sydney Thayer, Professor Emeritus of Medicine, Johns Hopkins University; Wilfred Trotter, F.R.C.S., Surgeon to University College Hospital; Théodore Martin Tuffier, Academy of Medicine, Paris; Sir Almroth Edward Wright, K.B.E., C.B., F.R.S., M.D., Professor of Experimental Pathology, University of London.

At a Graduation Ceremonial held in the M'Ewan Hall on 14th July 1927, the Degree of *Doctor of Medicine* was conferred on 16 graduates; and the Degrees of *Bachelor of Medicine and Bachelor of Surgery* on 107 candidates.

The following awards were made: *Thesis Gold Medals*.—John Gray, M.D.; Robert Gaskin Inkster, M.D.; Charles George Lambie, M.C., M.D. *The Cameron Prize in Practical Therapeutics*.—Frederick Grant Banting, M.C., M.B., D.Sc., LL.D., Professor of Medical Research in the University of Toronto, for his contributions to physiology and medicine, relating to Insulin. *The Straits Settlements Gold Medal*.—George Buchanan, M.D. *The Ellis Prize in Physiology*.—Morris Harris Finkelstein, B.Sc. *The Gunning Victoria Jubilee Prize in Anatomy*.—Donald Mainland, M.B., Ch.B. *The Gunning Victoria Jubilee Prize in Medicine*.—Ronald Victor Christie, M.B., Ch.B. *The Lauder Brunton Prize in Pharmacology and Therapeutics*.—George Hector Percival, M.B., Ch.B. *The Ettles Scholarship and Leslie Gold Medal*.—John M'Michael, M.B., Ch.B. *The Allan Fellowship in Clinical Medicine and Clinical Surgery*, John M'Michael, M.B., Ch.B. *The Murchison Memorial Scholarship in Clinical Medicine*.—John M'Michael, M.B., Ch.B. *The M'Cosh Graduate's and Medical Bursaries*.—William Anderson Robb, M.B., Ch.B. *The Mouat Scholarship in the Practice of Physic*.—John Douglas Bottomley, M.B., Ch.B. *The Buchanan Scholarship in Gynecology*.—David Glyn Lamond Lackie, B.A., M.B., Ch.B. *The James Scott Scholarship in Midwifery*.—Wilhelmina Mary Grace MacLennan, M.B., Ch.B. *The Beaney Prize in Anatomy and Surgery*.—John Douglas Bottomley, M.B., Ch.B. *The Conan Doyle Prize*.—George William

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Gale, M.Sc., M.B., Ch.B. *The Annandale Gold Medal in Clinical Surgery*.—Thomas Mackenzie Reid, M.B., Ch.B. *The Murdoch Brown Silver Medal in Clinical Medicine*.—John M'Michael, M.B., Ch.B. *The Royal Victoria Hospital Tuberculosis Trust Gold Medal*.—Kenneth Somerled Macdonald-Smith, M.B., Ch.B. *The Scottish Association for Medical Education of Women Prize*.—Wilhelmina Mary Grace MacLennan, M.B., Ch.B. *The Dorothy Gilfillan Memorial Prize*.—Wilhelmina Mary Grace MacLennan, M.B., Ch.B. *The Pattison Prize in Clinical Surgery*.—John M'Michael, M.B., Ch.B.; *Prox. acc.*, William Kerr Blackie, M.B., Ch.B. *The Wightman Prize in Clinical Medicine*.—Ian Aird. *The Wellcome Medals and Prizes in the History of Medicine*.—Gold Medal: James Douglas Allan Gray, B.Sc., M.B., Ch.B. Silver Medal: George William Gale, M.Sc., M.B., Ch.B. *The Cunningham Memorial Medal and Prize in Anatomy*.—Alexander Colin Patton Campbell. *The Whiteside Bruce Bursary*.—Thomas Hewitson Brown.

The Degree of *Doctor of Philosophy* in the Faculty of Medicine was conferred on George Hector Percival, M.B., Ch.B.

One candidate received *The Diploma in Tropical Medicine and Hygiene*; and four candidates received *The Diploma in Radiology*.

The Promoter, Professor Edwin Bramwell, addressed the graduates.

A QUARTERLY meeting of the Royal College of Physicians of Edinburgh was held on Tuesday, 12th July 1927, the President, Dr G. M. Robertson, in the Chair.

Dr Alfred Irving Shephard-Walwyn (Carlisle) and Dr Walter Duncanson Chambers (Perth) were introduced and took their seats as Fellows of the College.

Dr Robert Victor Morrison (Rangoon), Dr William Macrae Taylor (Edinburgh), Dr Douglas James Ackworth Kerr (Edinburgh), Dr William Alister Alexander (Edinburgh) and Dr Thomas Robert Rushton Todd (Edinburgh) were elected Fellows of the College.

On behalf of the College, Sir Norman Walker congratulated Dr George M. Robertson and Sir Robert Philip on the Honorary Fellowship of the Royal College of Surgeons of Edinburgh, which had recently been conferred upon them.

It was intimated that Dr George M. Robertson had been appointed a Trustee of the College.

THE Lister Centenary Commemoration Committee, responsible for the Lister Essay Prize arrangements for commemorating the one hundredth anniversary of the birth of Lord Lister, held in connection with the British Medical Association in July, awarded a

Books Received

money prize and gold medal for the best essay submitted on "The Influence of Lister on the Evolution of Surgery," to Mr George William Gale, M.Sc., M.B., Ch.B. Thirty-three Essays were submitted. Mr Wilfred Trotter, F.R.C.S., LL.D., London, and Professor John Marnoch, Aberdeen, acted as adjudicators.

BOOKS RECEIVED

- CROW, D. A. The Ear, Nose and Throat in General Practice.
(*Humphrey Milford, London*) 10s. 6d. net.
- DEEKS, WILLIAM E. Diet and Disease.
(Reprinted from the *American Journal of Tropical Medicine*,
Vol. VII, No. 3, May 1927.)
- DEUTSCH, FELIX, and EMIL KAUF. English Translation by LOUIS
M. WARFIELD. Heart and Athletics.
(*Henry Kimpton, London*) 10s. 6d. net.
- DOUTHWAITE, A. H. The Injection Treatment of Varicose Veins.
(*H. K. Lewis & Co. Ltd., London*) 3s. net.
- FITZWILLIAMS, D. C. L. The Tongue and its Diseases.
(*Humphrey Milford, London*) 36s. net.
- GHOSH, B. N. A Treatise on Hygiene and Public Health. Sixth
Edition (*Scientific Publishing Co., Calcutta*) 10s. net.
- GIBSON, ALEXANDER GEORGE, and WILLIAM TREGONWELL COLLIER.
The Methods of Clinical Diagnosis.
(*Edward Arnold & Co., London*) 12s. 6d. net.
- HIRSCH, CHARLES T. W. Ethyl Chloride.
(*John Bale, Sons & Danielsson, Ltd., London*) 1s. net.
- LEVINSON, ABRAHAM. Examination of Children by Clinical and
Laboratory Methods. Second Edition.
(*Henry Kimpton, London*) 15s. net.
- LEWIS, THOMAS. The Blood Vessels of the Human Skin and their
Responses. (*Shaw & Sons, Ltd., London*) 37s. 6d. net.
- M'CANN, FREDERICK J. The Effect of Contraceptive Practices on the
Female Sexual Organs.
(*Simpkin, Marshall, Hamilton Kent & Co. Ltd., London*) 1s. net.
- MYERS, J. A. The Normal Chest of the Adult and the Child.
(*Baillière, Tindall & Cox, London*) 22s. 6d. net.
- NEAME, HUMPHREY, and F. A. WILLIAMSON-NOBLE. Handbook of
Ophthalmology (*J. & A. Churchill, London*) 12s. 6d. net.
- PATTEN, BRADLEY M. The Early Embryology of the Chick. Second
Edition. (*John Murray, London*) 15s. net.
- Report by the Medical Officer of Health for the City of Aberdeen for
the year 1926.
- , HOMER ERASTUS. Applied Refraction.
(*E. & S. Livingstone, Edinburgh*) 15s. net.
- . STANLEY. A Manual of General Medical Practice.
(*H. K. Lewis & Co., Ltd.*) 7s. 6d. net.
- Company, Boston, Massachusetts Medical Department.
Annual Report, 1926.

MEDICAL EDUCATION IN SCOTLAND

THE MEDICAL CURRICULUM.

ACCORDING to the Regulations of the General Medical Council, a candidate for a medical qualification must (1) pass a preliminary examination in general education, and an examination in elementary physics and elementary chemistry; (2) register as a medical student; (3) study for five years at a recognised school; (4) obtain a degree or diploma; and (5) place his name on the *Medical Register*. No person whose name is not on the *Register* may legally sign certificates, give medical evidence in Courts, or sue for fees.

The following degrees and diplomas are available in Scotland: Bachelor of Medicine and Bachelor of Surgery (M.B., Ch.B.), conferred by the Universities. Doctor of Medicine (M.D.) and Master of Surgery (Ch.M.) are higher qualifications conferred only on those who already hold the M.B., Ch.B.

The *Triple Qualification* (L.R.C.P.E., L.R.C.S.E., L.R.F.P.S.G.) is conferred by the two Royal Colleges and the Royal Faculty jointly. The Fellowships, Memberships, and Licences of these Corporations may also be registered as higher or additional qualifications.

Special degrees and diplomas in public health, in tropical medicine, in psychiatry and in radiology are also granted by the Universities and Corporations.

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PRELIMINARY EXAMINATION.—Before commencing his course of medical study each student shall pass a preliminary examination in general education, and a pre-registration examination in elementary physics and elementary chemistry.

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Medical Education in Scotland

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Provision is made in the University for instruction in all subjects.

The examinations are written, oral, and practical, and are held twice yearly—viz., June and December.

Candidates are required on the first occasion of presenting themselves for examination to appear for all the subjects. Candidates who fail to pass the entire examination within a period of twelve months after first appearance are required to reappear for all the subjects.

The University is included in the list of Institutions whose courses of instruction in Tropical Medicine may be taken by Officers of all Colonial Medical Services on first appointment or during study-leave.

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Candidates for the Diploma must be graduates in Medicine and Surgery of the University of Edinburgh, or hold corresponding registrable degrees or qualifications of some other licensing body.

Candidates are required subsequent to the date of graduation or obtaining a registrable qualification, to have held (a) a resident appointment for one year in a Hospital for Mental Disorders approved by the Faculty of Medicine, or alternatively (b) a six months' appointment as defined in (a) and six months' practical study of nervous diseases in a special or general hospital approved by the Faculty of Medicine.

There are two examinations for the Diploma. Part I. comprises:—

1. Anatomy of the Nervous System.
2. Physiology of the Nervous System.
3. Psychology and Experimental Psychology.

Part II. comprises:—

1. Neuropathology.
2. Clinical Psychiatry.
3. Clinical Neurology.
4. An additional subject selected by the candidate from a prescribed list.

The examinations are held twice yearly, in March and July.

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J. Ryland Whitaker, M.B., Surgeons' Hall.
Charles R. Whittaker, F.R.C.S., Surgeons' Hall.

Physiology—Professor Sir E. Sharpey Schafer, LL.D., University.
Alexander Goodall, M.D., Surgeons' Hall.

Materia Medica and Therapeutics—Professor A. J. Clark, M.D., University.
John Orr, M.D., New School.

Pathology—Professor J. Lorrain Smith, M.D., LL.D., University.
Agnes M'Gregor, M.D., Surgeons' Hall.

Medical Education in Scotland

Surgery—Professor D. P. D. Wilkie, M.D., Ch.M., University.

A. A. Scot Skirving, F.R.C.S.

A. Pirie Watson, F.R.C.S., Surgeons' Hall.

Clinical Surgery—The Surgeons of the Royal Infirmary.

Professor John Fraser.

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J. D. Comrie, M.D., Dental Hospital.

Clinical Medicine—The Physicians of the Royal Infirmary.

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Dr John Eason.

Dr J. D. Comrie.

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G. F. B. Simpson, M.D., New School.

W. F. T. Haultain, M.B., F.R.C.S., Surgeons' Hall.

Mental Diseases—Professor G. M. Robertson, M.D., University and Royal Mental Hospital.

John Keay, M.D., Surgeons' Hall and Bangour Village Asylum.

Diseases of the Eye—J. V. Paterson, M.B., Royal Infirmary.

A. H. H. Sinclair, M.D., Royal Infirmary.

Vaccination—W. D. D. Small, M.D., Provident Dispensary.

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Norman M. Dott, F.R.C.S., Royal Hospital for Sick Children.

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Diseases of the Ear, Nose, and Throat—J. S. Fraser, F.R.C.S., Royal Infirmary.

J. D. Lithgow, F.R.C.S., Royal Infirmary.

Forensic Medicine—

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W. G. Aitchison Robertson, M.D., D.Sc., Surgeons' Hall.

Public Health—Professor P. S. Lelean, C.B., C.M.G., University.

Wm. Robertson, M.D., Surgeons' Hall.

Fevers—Alexander James, M.D., City Hospital.

W. T. Benson, M.D., City Hospital.

Bacteriology—Professor T. J. Mackie, M.D., University.

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In connection with the University and Royal Colleges, Post-Graduate Courses are held during the Summer Vacation. Usually there is a General Medical Course, a General Surgical Course, a Course on Diseases of Children, and a Course on Obstetrics and Gynecology.

The details of the Courses vary somewhat from year to year, but the General Practitioners' Course includes: Lecture-Demonstrations, and, where possible, practical instruction on Medical Anatomy, Medical Side-Room Work, Examination of the Blood, X-Ray and Electrical Therapy, Morbid Anatomy, and Post-Mortems; clinical instruction in Medicine, Diseases of Children, Diseases of the Skin, and Infectious Diseases. This year's course also included special instruction in the Methods of Examination of the Nervous, Circulatory, Respiratory, Alimentary, and Renal Systems, and in Diseases of the Ductless Glands.

The General Surgical Course includes: Lecture-Demonstrations on Surgical Anatomy, Surgical Pathology, and Surgical X-Ray Diagnosis; clinical instruction in Surgery at the Royal Infirmary and the Royal Hospital for Sick Children; clinical instruction in Venereal Diseases; Surgical Out-Patients; Surgical and Gynecological Operations; and special instruction in Abdominal and Genito-Urinary and other branches of Surgery.

The Course on Diseases of Children includes: Clinical Demonstrations on the common and important Medical and Surgical conditions of infancy and childhood, supplemented by lectures on special subjects, and preventive medicine in relation to children. (A restricted Course only is being given in 1927.)

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The Obstetrical and Gynecological Course includes: Clinical instruction in both these departments; Lecture-Demonstrations on Obstetrical and Gynecological Pathology; practical study in the Ante-natal department of the Royal Maternity Hospital; and, if desired, instruction in the management of Child Welfare Centres. (A restricted Course only in Clinical Obstetrics is being given in 1927.)

In addition to the above, certain other special Courses on, for example, Clinical Therapeutics, Venereal Diseases, and Diseases of Ear, Nose, and Throat, may possibly be held during the Academic Terms.

Particulars in regard to Courses, dates of commencement, fees, etc., may be had on application to the Hon. Secretary, Post-Graduate Courses in Medicine, University New Buildings, Edinburgh.

UNIVERSITY OF GLASGOW.

DEGREES OF M.B. AND CH.B.

During the last decade there has been a continual expansion of the facilities provided for both scientific and practical training. In 1919 three new Chairs were provided in Organic Chemistry, in Physiological Chemistry, and in Bacteriology, and eight new University Lectureships have been instituted—two in Tuberculosis, one in the Surgical Diseases of Children, one in the Medical Diseases of Children, one in Electrical Diagnosis and Therapeutics, one in Venereal Diseases, and two in Clinical Obstetrics. In 1923 and 1924, two new Chairs were founded—one in Public Health and one in Medical Pædiatrics.

The special feature of the school upon the practical side is the classification of the staff of Professors and Lecturers in the subjects of the two final years of study. Systematic as well as clinical classes are conducted not only at the Western Infirmary and adjoining University Buildings, but also at the Royal and Victoria Infirmaries. Students accordingly have the option of taking these subjects either at the Western or the Royal or the Victoria Infirmaries. In this way the advantage is afforded of a very wide clinical field along with systematic instruction under University Professors, and the great disadvantage of attending classes at Gilmorehill and going to the Royal Infirmary, at a considerable distance, for clinical work is thus done away with. The large district hospitals of the Glasgow Parish Council are now also available for the teaching of Clinical Surgery and Clinical Medicine. The same arrangement has been made in the case of Pathology. There are large and fully equipped Pathological Institutes, with class-room accommodation, at both Infirmaries, each under a University Professor who is *ex officio* Pathologist to the Infirmary, and has control of all the pathological material for purposes of instruction and investigation.

There is a Laboratory for Clinical Pathology at the Western Infirmary, the Director of which is also a University Professor, and gives instruction to University students in the scientific methods of clinical diagnosis.

Under the New Ordinance of the University Court, which came into operation on 1st October 1911, the regulations for these degrees have been considerably altered, the chief modifications being as follows: 1. A re-arrangement of the subjects of the four Professional Examinations. 2. The rendering compulsory of some courses which hitherto have been optional.

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3. The imposition of restrictions as to the period at which certain subjects of the curriculum can be taken.

The academical year is now divided into three terms of about ten teaching weeks each, and the following list gives the subjects of the several Professional Examinations, with the period of study required :—

PRE-REGISTRATION EXAMINATION.

Physics (with practical work), 1 term.
Chemistry (with practical work), 1 term.

FIRST EXAMINATION.

Medical Chemistry (with practical work), 2 terms.
Medical Physics (with practical work), 1 term.
Botany (with practical work), 1 term.
Zoology (with practical work), 1 term.

SECOND EXAMINATION.

Anatomy and Practical Anatomy, 5 terms.
Physiology and Practical Physiology, 3 terms.

THIRD EXAMINATION.

Materia Medica and Therapeutics, 2 terms.
Pathology and Practical Pathology, 3 terms.

FOURTH EXAMINATION.

Medical Jurisprudence, 1 term.
Public Health, 1 term.
Surgery, 2 terms.
Practice of Medicine, 2 terms.
Midwifery and Diseases Peculiar to Women and Infants, 2 terms.

The candidate must have attended the Medical and Surgical practice of a general hospital for three years, and courses of Clinical Surgery and Clinical Medicine of nine months in each case. He must also have received instruction, under conditions laid down, in the following subjects :—

| | |
|---|--|
| Mental Diseases. | Diseases of the Ear, Throat, and Nose. |
| Practical Pharmacy. | Dermatology. |
| Out-Patient Practice. | Practical Midwifery with the Conduct of Cases of Labour. |
| Clinical Clerking in Medicine. | Vaccination. |
| Clinical Clerking or Dressing in Surgery. | Administration of Anæsthetics. |
| Post-Mortem Examinations. | Operative Surgery. |
| Infectious Diseases. | Venereal Diseases. |
| Gynæcology. | Tuberculosis. |
| Diseases of Children. | |
| Ophthalmology. | |

The following courses cannot be taken till after the end of the terms of the curriculum indicated in each case :—

Physiology and Practical Physiology—third term, and not till all four of the subjects of the First Examination have been passed.

Medical Education in Scotland

Materia Medica and Therapeutics, and Pathology and Practical Pathology—sixth term, and not till one subject at least of the Second Examination has been passed.

Medical Jurisprudence and Public Health—after completion of classes for the Third Professional Examination.

Midwifery, etc., Surgery and Medicine—ninth term, with the exception that Surgery may be attended after the sixth term, provided that the candidate has passed the Second Professional Examination.

Hospital Practice, Clinical Medicine, Clinical Surgery—sixth term.

After registration as a medical student in the books of the General Medical Council, the curriculum extends over five years, two of which must be spent in the University of Glasgow. The remaining three years may be spent elsewhere, as indicated in the Ordinance and under the conditions thereby imposed.

Except in the case of Medicine, Surgery, and Midwifery, the Senate may accept the Professional Examinations of other Scottish Universities.

There are a number of other administrative regulations which need not here be specified in detail.

The examination fees are £34, 13s. in all, with an additional fee of £2, 2s. for every re-entry. The cost of the curriculum amounts roughly to £250, spread over the five years of the course, and at present the class fees are charged at so much a class. There is, however, a movement on foot to introduce a "composition" or "inclusive" fee per session, but the total will work out at practically the above figure.

CLINICAL FACILITIES.

The following general hospitals, all of which are equipped in a modern fashion, are available for instruction of University students, viz. the Western Infirmary close to the University, the Royal Infirmary, to which the new Medical Chairs are attached, each of these having at present about 600 beds, and the Victoria Infirmary, with 260 beds, on the south side of the city.

The large district hospitals of the Glasgow Parish Council are now also available for the teaching of Clinical Surgery and Clinical Medicine.

The Eye Infirmarys at 174 Berkeley Street and 80 Charlotte Street (between them 100 beds), and the Ophthalmic Institution at 126 West Regent Street (35 beds), furnish ample opportunities for instruction in the important branch with which they deal; Insanity is equally well provided for at Gartnavel (460 beds), at Hawkhead (700 beds), at Gartloch (806 beds), and at Woodilee (1160 beds), while the City Fever Hospitals at Ruchill (540 beds) and Belvidere (680 beds) are available for the study of Zymotic Diseases. The Ear, the Throat and Nose, and the Skin are dealt with in the Western and Royal Infirmarys.

The Maternity Hospital, with every modern convenience and equipment, is situated in Rottenrow, and has accommodation for 104 patients. A new hospital for Sick Children, of greatly increased dimensions, in freer air, has been erected at Yorkhill within a short distance of the University. The beds number 270.

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The Ordinance is applicable alike to men and women students, and much of the instruction is given in "mixed" classes by the Professors. There are, however, exceptions to this, some classes for women alone being held in a separate building (Queen Margaret College), and some for both sexes (in the main buildings at Gilmorehill) at different hours. Women are now admitted both to the Western and Royal Infirmaries on the same terms as men.

PROFESSORS.

- Zoology*—Professor Graham Kerr, M.A., F.R.S.
Chemistry—Professor G. G. Henderson, M.A., D.Sc., LL.D., F.R.S.
Organic Chemistry—Professor T. S. Patterson, D.Sc., Ph.D.
Natural Philosophy—Professor E. Taylor Jones, M.A., D.Sc.
Applied Physics—Professor J. G. Gray, D.Sc.
Botany—Professor Drummond, B.A., F.R.S.E., F.L.S.
Anatomy—Professor Bryce, M.A., M.D., F.R.S.
Physiology—Professor Noël Paton, B.Sc., M.D., LL.D., F.R.S.
Physiological Chemistry—Professor E. P. Cathcart, C.B.E., M.D., D.Sc., F.R.S.
Materia Medica and Therapeutics—Professor Stockman, M.D., LL.D.
Pathology—Professor Muir, M.A., M.D., LL.D., F.R.S.
Medical Jurisprudence—Professor Glaister, M.D., D.P.H. (Camb.).
Surgery and Clinical Surgery—Professor Young, B.Sc., M.B.
Midwifery—Professor John M. Munro Kerr, M.D.
Practice of Medicine and Clinical Medicine—Professor T. Kirkpatrick
Monro, M.A., M.D.
Public Health—Professor J. R. Currie, M.A., M.D., D.P.H.
Pathology—Professor John H. Teacher, M.A., M.D.
Bacteriology—Professor Carl H. Browning, M.D., D.P.H.
Medicine and Clinical Medicine—Professor Walter K. Hunter, D.Sc., M.D.
Surgery and Clinical Surgery—Professor P. Paterson, M.B.
Midwifery—Professor James Hendry, M.B.E., M.A., B.Sc., M.B.
Medical Pædiatrics—Professor Leonard Findlay, D.Sc., M.D.

LECTURERS.

- Clinical Medicine*—John M. Cowan, B.A., M.D., D.Sc.
A. W. Harrington, M.D.
John Henderson, M.D.
John C. Middleton, M.A., B.Sc., M.B.
Douglas W. Russell, M.B.

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Clinical Surgery—Donald Duff, F.R.C.S. (Ed.).

G. H. Edington, M.D., D.Sc.

Thomas Kay, M.B.

John A. C. Macewen, M.B., B.Sc.

Milne M'Intyre, M.B.

F. Macrae, M.B.

John Patrick, M.A., M.B.

J. Mill Renton, M.B.

Roy F. Young, M.B.

Clinical Tuberculosis—James Crockett, M.D., D.P.H.

J. A. Wilson, M.B., D.P.H.

Diseases of the Ear—James Harper, M.A., M.B.

Albert A. Gray, M.D.

Diseases of the Throat and Nose—James Harper, M.A., M.B.

W. S. Syme, M.D.

Diseases of the Eye—Arthur J. Ballantyne, M.D.

Gynaecology—David Shannon, M.B.

Clinical Gynaecology—Sam. J. Cameron, M.B.

Medical Diseases of Infancy and Childhood—Geoffrey B. Fleming, M.D.

Surgery and Orthopaedics in Relation to Infancy and Childhood—Alexander MacLennan, M.B.

Electrical Diagnosis and Therapeutics—James R. Riddell, F.R.F.P.S.G.

Andrew B. MacLean, M.D.

Dermatology—J. Ferguson Smith, M.A., M.B.

J. Wyllie Nicol, M.B.

Psychological Medicine—J. H. MacDonald, M.B.

Psychiatry (Mental Diseases)—David K. Henderson, M.D.

Venereal Diseases—David Watson, M.B.

Bio-Chemistry—Stephen V. Telfer, B.Sc., M.B., and David P. Cuthbertson, B.Sc., M.B.

DEAN.

Professor J. R. Currie, M.A., M.D., D.P.H.

DEGREE OF M.D.

This degree is open to holders of the M.B., Ch.B. diploma, after a period of one or two years, according to circumstances, has elapsed since the date of the latter. The requirements are (a) an Examination in Clinical Medicine, or in some approved department of Medical Science or Practice; (b) a Thesis on any branch of knowledge comprised in the examinations for M.B., Ch.B., excepting a subject which is exclusively surgical; and (c) a fee of £21 with an extra charge of £5, 5s. for each re-entry.

DEGREE OF CH.M.

This may be obtained on practically the same terms as the M.D. degree, the only differences being (1) that the examination is on Surgical Anatomy, operations upon the dead body, on Clinical Surgery or an approved special department of Surgery, and (2) that the Thesis must not be on a subject which is exclusively medical.

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DEGREE OF B.SC. IN PUBLIC HEALTH.

Candidates must be Graduates in Medicine of a University of the United Kingdom, or of some other University recognised for the purpose by the Glasgow University Court, and they must thereafter have, during a period of not less than twenty-one months, pursued the course of work and instruction prescribed, viz. :—

- (a) Bacteriology and Parasitology (including Medical Entomology), especially in their relation to diseases of man and to those diseases of the lower animals which are transmissible to man.
- (b) Chemistry and Physics in relation to Public Health.
- (c) Meteorology and Climatology in relation to Public Health.
- (d) Higher Chemistry in relation to Public Health.
- (e) Physics, and (f) Geology, recognised as qualifying for graduation in Science or in Arts at the University of Glasgow.
- (g) (i.) The Principles of Public Health and Sanitation.
(ii.) Epidemiology and Vital Statistics.
(iii.) Sanitary Law and Administration, including Public Medical Services.
(iv.) Sanitary Construction and Planning.
- (h) Mensuration and Drawing in relation to Public Health.
- (i) The Clinical Practice of a Hospital for Infectious Diseases, and have received therein instruction in the methods of administration.
- (j) A practical knowledge of the duties, routine and special, of Public Health Administration under the supervision of a Medical Officer of Health, who shall certify that the candidates have received, from this officer or other competent Medical Officer, during not less than three hours on each of sixty working days, practical instruction in these duties, and also those relating to—
 - (i.) Maternity and Child Welfare Service.
 - (ii.) Health Service for Children of School Age.
 - (iii.) Venereal Diseases Service.
 - (iv.) Tuberculosis Service.
 - (v.) Industrial Hygiene.
 - (vi.) Inspection and Control of Food, including Meat and Milk.

The examinations are :—

PART I.

- (i.) Bacteriology and Parasitology (including Medical Entomology).
- (ii.) Chemistry and Physics in relation to Public Health.
- (iii.) Meteorology and Climatology in relation to Public Health.
- (iv.) Higher Chemistry in relation to Public Health.
- (v.) Physics and Geology.

A candidate must pass in the subjects marked (i.), (ii.), and (iii.) of Part I. at one examination.

PART II.

- (vi.) Hygiene and Sanitation (including Sanitary Construction).
- (vii.) Epidemiology and Infectious Diseases.
- (viii.) Sanitary Law and Vital Statistics.
- (ix.) Public Health Administration.
- (x.) Applied Hygiene.

Medical Education in Scotland

The examination for Part II. shall include practical examinations in Infectious Diseases, Food Inspection, Inspection of Premises, such as Dwellings, Factories, Workshops, Schools, and the like. The examination in Applied Hygiene shall be on the selected subject professed by the candidate. A candidate must pass in the subjects marked (vi.), (vii.), (viii.), and (ix.) of Part II. at one examination.

DIPLOMA IN PUBLIC HEALTH.

Candidates must be legally qualified medical practitioners whose names are registered in the *Medical Register*.

The candidates must, during a period of not less than twelve calendar months, pursue the course of work and instruction prescribed which are the same as for the B.Sc. Degree in Public Health, with the omission of (d), (e), (f), and (h).

The methods and standard of examination are the same as for the degree, with the omission of (iv.), (v.) of Part I., and (x.) of Part II.

DEGREE OF D.SC. IN PUBLIC HEALTH.

Five years after obtaining the B.Sc. degree, graduates may proceed to the higher degree of D.Sc., the requirements being (a) a Thesis or a published memoir or work to be approved by the Senate; and (b) an examination in Public Health and in such of its special departments as the Senate and University Court may determine. The fee for this degree is £15, 15s.

POST-GRADUATE MEDICAL TEACHING IN GLASGOW.

Organised Post-Graduate Medical Teaching is now available in Glasgow under the auspices of Glasgow Post-Graduate Medical Association. This Association is composed of practically all the Teaching Institutions in Glasgow, and the various Teachers giving Post-Graduate instruction, and its business is managed by a Board elected periodically by them. The Chairman of the Board is Principal Sir Donald MacAlister, Bt., K.C.B., M.D., LL.D., and the Vice-Chairman Sir Hector C. Cameron, C.B.E., M.D., LL.D.

Weekly Demonstrations for Practitioners are given throughout the Winter and Spring, and comprehensive courses of instruction during the Summer and Autumn. Arrangements have also been made whereby a limited number of graduates may become attached to Wards or Out-patient Departments nominally as Clinical Assistants for definite periods throughout the year. As such they work under the direct supervision of the Physician or Surgeon in charge, and carry out such detailed investigations as directed.

Those desiring further information should apply to Dr James Carslaw, Secretary, Post-Graduate Medical Association, University, Glasgow.

QUEEN MARGARET COLLEGE FOR WOMEN.

(WOMEN'S DEPARTMENT OF THE UNIVERSITY OF GLASGOW.)

This is an integral part of the University of Glasgow. The courses, regulations, and fees for the medical course are the same as for men. The instruction is given by University Professors and Lecturers appointed by the University Court, partly in mixed and partly in separate classes. The College provides a separate building, with class-rooms, laboratories, library,

Glasgow

and other teaching appliances. The administrative offices of the Women's Department are at Queen Margaret College. The women have all the rights and privileges of University students. Clinical work is amply provided for in the Royal Infirmary and its Dispensaries, the Western Infirmary, the Victoria Infirmary, the Royal Hospital for Sick Children, the Glasgow Maternity Hospital, the Royal Asylum of Gartnavel, Belvidere and Ruchill Fever Hospitals, etc.

There are three small halls of residence near the College, two of them under the jurisdiction of the University, and a list of lodgings can be obtained from the College Office.

All necessary information can be had from the Secretary to the Mistress, Queen Margaret College, Glasgow.

ST MUNGO'S COLLEGE.

St Mungo's College is contiguous to the Royal Infirmary, which is the largest hospital in Glasgow, and is situated in Cathedral Square, Castle Street. The classes are open to women students. There is car communication with every part of the city.

The College affords full courses in all the subjects of the medical and dental curricula. Many of the classes are recognised by the Universities of Glasgow and Edinburgh for graduation purposes. The average class fee is £4, 4s. for a Winter Course and £3, 3s. for a Summer Course. A Syllabus of Classes can be obtained on application to the Secretary to the Medical Faculty, St Mungo's College, 86 Castle Street.

The Infirmary has, including the Ophthalmic Department, over 835 beds. There are special beds and wards for Diseases of Women, of the Throat, Nose and Ear, Skin, Venereal Diseases, Burns, and Septic Cases.

In addition to the large Medical and Surgical Departments, there are Departments for Special Diseases—namely, Diseases of Women, of the Throat and Nose, of the Ear, of the Eye, of the Skin, and of the Teeth. A fully-equipped Electrical Pavilion was opened a few years ago, and year by year the latest and most approved apparatus for diagnosis and treatment has been added.

Appointments.—Five House Physicians and twelve House Surgeons, having a legal qualification in Medicine and Surgery, who board in the Hospital free of charge, are appointed every six months. Clerks and Dressers are appointed by the Physicians and Surgeons. As a large number of cases of acute diseases and accidents of a varied character are received, these appointments are very valuable and desirable.

Fees.—The fees for (a) hospital attendance, including attendance at the Outdoor Department, at the Pathological Department, Post-Mortem Examinations, and the use of the Museum, and (b) Clinical Lectures, are as follows :—

(a) For Infirmary Attendance, Dispensary, etc.—

| | | | | | | | |
|---------------------------|---|---|---|---|-----|----|---|
| A. For Perpetual Ticket. | . | . | . | . | £12 | 12 | 0 |
| B. For Single Term Ticket | . | . | . | . | 1 | 11 | 6 |

(b) For Clinical Instruction—

| | | | | | | | |
|--------------------------|---|---|---|---|----|----|---|
| Two terms or six months | . | . | . | . | £5 | 5 | 0 |
| One term or three months | . | . | . | . | 2 | 12 | 6 |

Medical Education in Scotland

THE ANDERSON COLLEGE OF MEDICINE.

DUMBARTON ROAD, PARTICK, GLASGOW.

The old Institution known as "Anderson's University" was founded by the will of John Anderson, M.A., F.R.S., in 1795, and the medical school connected therewith dates back to the year 1799.

In 1877 the name of the Institution was altered from "Anderson's University" to "Anderson's College." In 1887 the medical school of Anderson's College became a distinct Institution known as "Anderson's College Medical School." It is now incorporated as "The Anderson College of Medicine."

The new buildings are situated in Dumbarton Road, adjoining the Western Infirmary and the University. They are constructed on the best modern principles, and are provided with all the appliances requisite for the conduct and management of a fully equipped medical school.

Classes are conducted in all the subjects of the five years' curriculum:—

Anatomy—Professor John Graham, M.B., Ch.B., B.Sc.

Physics—Professor Jas. M. Macaulay, B.Sc., Ph.D.

Chemistry—Professor Geo. Cruikshanks, Ph.D., F.I.C.

Botany—Professor B. G. Cormack, M.A., B.Sc.

Zoology—Professor Peter Macnair, F.G.S., F.R.S.E.

Physiology—Professor N. Morris, M.D., B.Sc., D.P.H.

Materia Medica—Professor J. R. C. Gordon, L.R.C.S.E., L.R.C.P.E., F.R.F.P.S.G.

Medical Jurisprudence—Professor Carstairs Douglas, D.Sc., M.D., F.R.S.E.

Midwifery—Professor Jas. H. Martin, M.D., F.R.F.P.S.G.

Surgery—Professor James Russell, M.B., F.R.C.S.E.

Practice of Medicine—Professor O. H. Mavor, M.B., F.R.F.P.S.

Ophthalmic Medicine and Surgery—Professor S. Spence Meighan, B.Sc., M.B.

Aural Surgery—Professor James Galbraith Connal, M.D.

Diseases of Throat and Nose—Professor George B. Brand, M.B., F.R.F.P.S.G.

Mental Diseases—Professor W. Kilpatrick Anderson, M.B., Ch.B.

Pathology—At the Western or Royal Infirmary.

Diseases of the Skin—Professor J. Goodwin Tomkinson, M.D.

Dean of the Medical Faculty—Professor John Graham.

President of Governors—W. P. Ure, Esq.

Secretary to Governors—A. Lawrie Brown, 88 Bath Street, Glasgow.

Degrees and Diplomas.—Certificates of attendance on the classes at The Anderson College of Medicine are received by the Universities of London and Durham, by the Royal University of Ireland, and by all the Royal Colleges and Licensing Boards in the United Kingdom. They are also recognised by the Universities of Glasgow and Edinburgh under certain conditions which are stated in the Calendar of this school.

Aberdeen

Malcolm Kerr Bursary in Anatomy. Value about £10. Open to students of the junior anatomy class.

The Carnegie Trust will pay the fees of students at Anderson's, on conditions regarding which particulars may be obtained from The Secretary, Carnegie Trust Offices, Edinburgh.

Class Fees.—For each course of lectures (aural surgery, ophthalmology, diseases of throat and nose, and mental diseases excepted), £4, 4s. For practical classes (except anatomy and chemistry), viz., botany, zoology, physics, physiology, pharmacy, and operative surgery, £3, 3s. Anatomy—Winter—Lectures, £4, 4s.; practical anatomy, £5, 5s.; summer lectures, £2, 2s.; practical anatomy, £2, 12s. 6d. Practical chemistry, £5, 5s. Ophthalmic medicine and surgery, £3, 3s.; mental diseases, £3, 3s.; diseases of the skin, throat and nose, aural surgery, £2, 2s. Medical Jurisprudence—For the triple qualification, £4, 4s.

UNIVERSITY OF ABERDEEN.

The course of study for the degree of M.B., Ch.B. extends over five years, of which two at least must be spent in the University of Aberdeen.

The curriculum is the same as in the other Scottish Universities as far as relates to attendance on University classes, to clinical study at a General Hospital, to attendance on courses of Clinical Surgery, Clinical Medicine, Mental Diseases, and Practical Pharmacy, Operative Surgery, Anæsthetics, to instruction in Vaccination, to attendance on twenty Cases of Labour, and to the practice of a Dispensary.

The candidate must also, before admission to the final examination, produce the following certificates:—

1. That he has been present at not fewer than twenty-five post-mortem examinations, some of which he must have personally taken part in performing.

2. That he has attended a course of instruction in Infectious Diseases consisting of not fewer than twenty meetings, in a Hospital for the treatment of such diseases containing at least a hundred beds.

3. That he has attended in a Hospital a course of instruction in Gynecology consisting of not fewer than twenty meetings.

4. That he has attended in a special Hospital a course of instruction in the Diseases of Children, consisting of not fewer than twenty meetings.

5. That he has attended in the Ophthalmological Department of a Hospital or Dispensary a course of instruction in Ophthalmology, consisting of not fewer than thirty meetings extending over one term.

6. That he has attended in a Public Hospital or Dispensary a course of instruction in Diseases of the Ear, Nose, and Throat, consisting of not fewer than twenty meetings.

7. That he has attended in a Public Hospital or Dispensary a course of instruction in Dermatology, consisting of not fewer than twenty meetings.

8. That he has attended a course of instruction in Venereal Diseases, consisting of not fewer than twelve meetings, in a recognised Hospital or Clinic centre for the treatment of such diseases.

Medical Education in Scotland

9. That he has attended in a Hospital a course of instruction in Tuberculosis consisting of not fewer than twenty meetings.

10. That he has attended in a Public Hospital a course of instruction in Radiology, X-Ray Therapeutics and Electrical Treatment, consisting of not less than ten meetings.

11. That he has received instruction in Clinical Pathology, including Chemical Methods.

Certificates for these various classes and courses must attest not only regular attendance, but also due performance of the work.

The order of study is prescribed by the Senatus and a scheme, representing the minimum curriculum, has been drawn up for the guidance of students, and is printed in the Calendar.

THE FOLLOWING ARE THE CLASSES IN THE MEDICAL FACULTY:— WINTER SESSION.

Zoology—Professor John Arthur Thomson, M.A., LL.D.

Chemistry (Syst. and Pract.)—Professor Alexander Findlay, M.A., D.Sc., Ph.D.

Anatomy—Professor Alexander Low, M.A., M.D.

Practical Anatomy—Professor Alexander Low, M.A., M.D.

Physiology (Syst. and Pract.)—Vacant.

Materia Medica—Professor Charles R. Marshall, M.A., M.D., LL.D.

Pathology (Syst. and Pract.)—Professor Theodore Shennan, M.D., F.R.C.S.E.

Bacteriology—Professor John Cruickshank, M.D.

Public Health—Mr John Parlane Kinloch, M.D., and Mr Douglas W. Berry, M.D., *Lecturers*.

Surgery—Professor John Marnoch, C.V.O., M.A., M.B., C.M.

Medicine—Professor Mackintosh, M.A., M.D.

Midwifery and Diseases of Women and Children—Professor R. G. M'Kerron, M.A., M.D.

SUMMER SESSION.

Botany—Professor William G. Craib, M.A., F.L.S., F.R.S.E.

Practical Botany—Professor William G. Craib.

Zoology—Professor John Arthur Thomson.

Practical Zoology—Professor John Arthur Thomson.

Physics—Professor G. P. Thomson, M.A.

Practical Anatomy—Professor Alexander Low.

Practical Materia Medica and Pharmacy—Professor Charles R. Marshall, M.A., M.D.

Physiology (Syst. and Pract.)—Vacant.

Forensic Medicine—Vacant.

Pathology (Syst. and Pract.)—Professor Shennan.

Practical Midwifery and Gynecology and Clinical Diseases of Children—Professor M'Kerron.

Operative Surgery—Professor Marnoch.

Tropical Medicine—George A. Williamson, M.A., M.D.

Medical Ethics—George Williamson, M.A., M.B.

Aberdeen

There are Assistants to all the Professors in the Medical Faculty, and also Lecturers in various departments—Zoology, Chemistry (2), Anatomy, Embryology, Parasitology, Bio-Chemistry, Experimental Physiology, etc.

Clinical Medicine and Clinical Surgery are taught by the Physicians and Surgeons of the Royal Infirmary.

The following are recognised as Lecturers:—

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| Mental Diseases . . . | R. Dods Brown, M.D., F.R.C.P.E., Dip. Psych. |
| Ophthalmology . . . | C. H. Usher, M.B., B.S., F.R.C.S. A. Rudolph Galloway, M.A., M.B., C.M. |
| Vaccination . . . | John Brown, M.B. |
| Skin Diseases and Venereal Diseases | J. F. Christie, M.A., M.B., C.M., F.R.C.P. |
| Diseases of Ear, Throat, and Nose . . . | H. Peterkin, M.B., and Hugh Ross Souper, M.D. |
| Medical Electricity . . | J. R. Levack, M.B., C.M. |
| Anæsthetics . . . | Alex. Ogston, M.B., C.M., and J. Ross Mackenzie, M.D. |
| Dental Surgery . . . | J. M. P. Crombie, M.B., C.M., L.D.S. (Eng.). |
| Medical Inspection of School Children . . | George Rose, M.B. |
| Tuberculosis . . . | George S. Banks, M.B. |
| Maternity and Infant Welfare . . . | James A. Stephen, M.A., M.B. |

All the University Classes are held at Marischal College.

Tutorial Classes are held in connection with most of the Systematic Courses, and practical instruction is given in the fully equipped Laboratories connected with the several departments.

Graduates or others desirous of engaging in special study or research may be allowed by the Senatus to work in any of the Laboratories on payment of the usual matriculation fee.

General clinical instruction is obtained in the following Medical Institutions:—

The Royal Infirmary of Aberdeen.

This General Hospital, situated about seven minutes' walk from Marischal College, is constructed on the most modern principles, and is fully equipped with all the requirements for medical work and teaching. It accommodates upwards of 335 patients. There are also facilities for the treatment of out-door patients.

Six resident medical officers are appointed annually, three in May and three in September, to hold office for twelve months. Salary, £52, 10s. with board, rooms, laundry.

Fees.—Perpetual fee to hospital practice, £10, or first year, £5, 10s., second year, £5, afterwards free; short period fees, 3 terms (one year), £4, 4s.; 2 terms, £3, 3s.; 1 term, £1, 11s. 6d.; clerkship in medicine, £1, 1s.; dresser-ship in surgery, £1, 1s.; pathological demonstrations, £2, 2s. (Special courses of lectures are charged for.)

Medical Education in Scotland

The Royal Hospital for Sick Children

Is situated about five minutes' walk from Marischal College, and accommodates over 80 patients. There are also facilities for the treatment of out-door patients. Each student must act as clerk for six weeks in the medical and surgical wards respectively.

There are three resident medical officers, who hold office for six months.

Fees: for hospital practice, £1, 1s.; for course on diseases of children, £3, 3s.

The Royal Mental Hospital

Is about fifteen minutes' walk from Marischal College. It accommodates over 950 patients, and is fitted up with a fully equipped hospital and a laboratory.

The senior physician is recognised by the University as lecturer on mental diseases, and delivers a qualifying course of lectures.

The fee for the course is £2, 2s.

The City (Fever) Hospital

Is about ten minutes' walk from Marischal College, and accommodates 350 patients.

Senior students are admitted for instruction in fevers under the visiting physician (who is the Medical Officer of Health for the City) and his assistant. Fee, £2, 2s.

General Dispensary and Vaccine Institution

This is about five minutes' walk from Marischal College.

In addition to treatment at the dispensary, patients are also treated at their own homes.

Fees.—General practice, £3, 3s.; vaccination certificate and instruction, £1, 1s.

Aberdeen Maternity Hospital.

This Institution is situated at the top of Castle Terrace, less than ten minutes' walk from Marischal College. The hospital contains 32 beds, and patients are also treated at their own homes. Fee, £3, 3s.

The Eye Institution.

This Institution is situated about three minutes' walk from Marischal College. The surgeon in charge is recognised by the University as a lecturer on ophthalmology.

PROFESSIONAL EXAMINATIONS.

There are four examinations; the subjects and regulations of these are common to the Universities of Aberdeen and Glasgow.

DEGREE OF M.D.

The regulations with regard to the age and other qualifications of the candidate are similar to those in the other Scottish Universities. He must submit a thesis (in duplicate) written by himself upon any medical subject, and pass an examination in Clinical Medicine or in some Special Department of Medical Science or Practice.

Aberdeen

DEGREE OF CH.M.

Each candidate must be not less than twenty-four years of age, and must hold the degree of M.B., Ch.B. of the University. He must produce a certificate of having been engaged for at least one year in attendance in the surgical wards of a hospital, or in scientific research, or in the naval and military services, or for two years in practice other than practice restricted to medicine. He must present a thesis (in duplicate) on a surgical subject and pass an examination on Clinical Surgery, Surgical Anatomy, and Operations on the Dead Body.

DEGREE OF PH.D.

The Degree of Doctor of Philosophy (Ph.D.) is also granted in the Faculty of Medicine.

DIPLOMA IN PUBLIC HEALTH (D.P.H.).

Regulations Approved by the University Court, 15th January 1924.

I.—Every candidate for the Diploma must be a graduate in Medicine of the University of Aberdeen, or of any other University whose medical degrees are recognised as qualifying for registration by the General Medical Council of the United Kingdom.

II.—No candidate will be admitted to the Final Part of the Examination for the Diploma until after the lapse of not less than two years from the date of his obtaining a registrable qualification in Medicine, which qualification shall have been registered before such admission.

III.—The whole of the prescribed curriculum of study must be undertaken after the candidate has obtained a registrable qualification in medicine, and shall extend over not less than twelve calendar months. At least one academic term must be spent at the University of Aberdeen.

IV.—Every candidate shall produce evidence of having complied with the following requirements in respect of study and training :—

(1) Practical instruction in the following subjects within a laboratory or laboratories approved by the University :—

(a) Bacteriology and parasitology (including medical entomology), in relation to diseases of man and diseases of lower animals transmissible to man—at least 180 hours, of which not less than 150 shall be occupied in practical laboratory work ;

(b) Chemistry and physics, in relation to public health—at least 90 hours, of which not less than 70 shall be occupied in practical laboratory work ;

(c) Meteorology and climatology, in relation to public health—at least 10 hours ;

such instruction to extend over not less than five months or two academic terms.

(2) A course or courses of instruction extending over not less than 80 hours dealing with :—

(a) The principles of public health and sanitation—30 hours ;

(b) Epidemiology and vital statistics—20 hours ;

(c) Sanitary law and administration (including public medical services)—20 hours ;

(d) Sanitary construction and planning—10 hours ;

such course or courses to be given at an institution or by a teacher or teachers approved by the University.

(3) Practical instruction, clinical and administrative, within a recognised hospital for general infectious diseases ; such instruction to extend over three months, and to include 30 daily attendances of not less than two hours in each week.

Medical Education in Scotland

(4) Practical instruction and experience, during not less than six months (including attendance of at least three hours on each of sixty working days), in the duties, routine and special, of public health administration, under the supervision of a medical officer of health, who shall certify that the candidate has received from this officer or other competent medical officer, practical instruction in these duties, and also in those relating to:—

- (a) Maternity and Child Welfare Service;
- (b) Health Service for Children of School Age;
- (c) Venereal Diseases Service;
- (d) Tuberculosis Service;
- (e) Industrial Hygiene;
- (f) Public Health Administration.

The medical officers of health recognised for this purpose by the General Medical Council are: (a) a medical officer of health who devotes his whole time to public health work; or (b) the medical officer of health of a sanitary area having a population of not less than 50,000; or (c) in Ireland, the medical superintendent officer of health of a county or county borough having a population of not less than 50,000.

V.—The examination for the Diploma is divided into two parts, each of which extends over not less than three days:—

Part I.—Bacteriology, parasitology (including medical entomology), chemistry, physics, meteorology, and climatology, in relation to public health.

- (a) Practical.
- (b) Written and oral.

Part II.—(1) Infectious diseases (including tuberculosis and venereal diseases), etiology, epidemiology, diagnosis, treatment, prophylaxis, disinfection, hospital provision, and administrative control.

- (a) Clinical,
- (b) Written and oral.

(2) Hygiene and sanitation (including sanitary construction).
Written and oral.

(3) Sanitary law and vital statistics.
Written and oral.

(4) Public health administration and health services.
Written, oral, and practical (including reports).

The examination includes practical examination in food inspection and inspection of such premises as dwellings, factories, workshops, schools, etc.

VI.—No candidate shall be held to have passed either in Part I. or in Part II. of the examination, unless he has passed in all the specified subjects of such Part as one period of examination.

VII.—Every candidate must have passed in Part I. of the examination before admission to Part II.

VIII.—The examination is conducted by such University teachers in the University and by such other persons as may be appointed for the purpose by the University Court.

IX.—The fee for the examination is four guineas for each part, or eight guineas for the whole examination. In the event of a candidate failing to pass the whole or any part of the examination, a fee of one guinea is payable for each subsequent examination for which he may present himself.

X.—The foregoing Regulations are subject to the requirements of the General Medical Council in force at the time in regard to Diplomas in Public Health.

St Andrews

FEEES.

Arrangements have been made, in conjunction with the other Scottish Universities, for the institution of an inclusive fee for the courses of instruction leading to the M.B. and Ch.B. degrees. The inclusive fee for instruction within the walls of the University is one hundred and twenty-six guineas, payable in five annual instalments.

The cost of matriculation, class and hospital fees for the whole curriculum, including the fees for the degrees, is usually about £236.

UNIVERSITY OF ST ANDREWS.

The degrees conferred are Bachelor of Medicine and Bachelor of Surgery (M.B., Ch.B.), Doctor of Medicine (M.D.), and Master of Surgery (Ch.M.).

Two constituent colleges of the University provide medical teaching—the United College at St Andrews and University College in Dundee. At St Andrews classes for two years may be taken, and the student may pass the first and second professional examinations at St Andrews. There are excellent opportunities for combining degrees in Arts and Science with those of Medicine. Inclusive fees have been arranged for students who wish to take advantage of these opportunities. There are many bursaries offered to students who desire to graduate in Medicine, and it should be added that the cost of rooms and of living in St Andrews is considerably less than in the larger University cities. For women, both at St Andrews and in Dundee, there are excellent residential halls provided, which are governed by the University authorities. The Medical School is carried on in buildings specially built for the purpose.

The Conjoint School of Medicine, Dundee, supplies a complete course of medical study, and the student from the United College, St Andrews, completes his curriculum there. Large modern buildings with well-equipped laboratories have been provided. Both in the Medical School and the wards of the Dundee Royal Infirmary the students have excellent opportunities for gaining a practical knowledge of medical science and of medical work, for they have individual attention and supervision which the larger schools cannot give.

The Dundee Royal Infirmary contains 400 beds, and includes special wards for obstetrics, gynecology, children's diseases, ophthalmology, dermatology, otology, and electrical therapeutics. New out-patient departments are now in use. There is a large out-door maternity department. Hospital Fees—Surgical and Medical, £4, 4s. yearly; Perpetual Ticket, £13, 6s. 8d., or in instalments, £14, 14s.; Obstetric Cases, £2, 2s.; Obstetric Clinic, £1, 1s.

Westgreen Asylum at Liff provides abundant material for instruction in mental diseases, and the City Fever Hospital in fevers. The Dundee Eye Institution furnishes cases for instruction in ophthalmology.

The Diploma of Public Health (D.P.H.) may be taken at the Conjoint School of Medicine, Dundee.

A Diploma in Dental Surgery (L.D.S.) is also granted by the University. Instruction in the University, Royal Infirmary, and Dundee Dental Hospital.

All classes in the University are open to men and women alike.

Medical Education in Scotland

UNITED COLLEGE, ST ANDREWS.

PROFESSORS AND LECTURERS.

Physics—Professor Stanley Allen.

Chemistry—Professor Read.

Zoology—Professor Thomson, C.B., M.A., D.Litt., F.R.S.

Botany—R. A. Robertson, M.A., B.Sc.

Physiology—Professor Herring, M.D.

Anatomy—Professor D. Waterston, M.D., F.R.C.S.

UNIVERSITY COLLEGE, DUNDEE.

PROFESSORS AND LECTURERS.

Physics—Professor Peddie, D.Sc.

Chemistry—Professor Mackenzie, D.Sc., F.R.S.

Botany—Miss Smith.

Physiology—Professor Waymouth Reid, M.B., Sc.D., F.R.S.

Anatomy—R. Rutherford Dow, M.D.

John Taylor, M.D., Ch.M.

Surgery—Professor L. Turton Price, Ch.B., F.R.C.S.

Surgery, Clinical—Professor Price; J. Anderson, F.R.C.S.E.; R. C. Alexander, F.R.C.S.E.

Medicine—Professor Patrick, M.D.

Medicine, Clinical—Professor Patrick, M.D.; Professor Charteris, M.D.; W. E. Foggie, M.D.; C. Kerr, M.B.

Materia Medica—Professor F. Charteris, M.D.

Pathology—Professor Sutherland, M.B.

Midwifery and Gynecology—Professor Kynoch, M.B., F.R.C.P., F.R.C.S.

Midwifery and Gynecology, Clinical—Professor Kynoch, M.B., F.R.C.S., F.R.C.P.

Forensic Medicine—David Lennox, M.D.

Public Health—W. L. Burgess, M.D., D.P.H.

Ophthalmology—Angus MacGillivray, M.D., D.Sc.

Diseases of Ear, Nose, and Throat—R. P. Mathers, M.D.

Diseases of Children—Professor L. T. Price.

J. S. Y. Rogers, M.B.

Diseases of Skin—F. M. Milne, M.A., M.B., Ch.B., B.Sc.

Mental Diseases—W. Tuach Mackenzie, M.D.

Vaccination—Douglas Scott, M.B., Ch.B.

Fevers—W. L. Burgess, M.D., D.P.H.

Clinical Pathology—F. M. Milne, M.B., D.P.H.

Qualifications given by the Scottish Colleges

Clinical Surgical Tutors—John Taylor, M.Ch. ; F. R. Brown, F.R.C.S.E.

Anæsthetics—A. Mills, M.D.

Bacteriology—Professor W. J. Tulloch, M.D.

Dean of the Faculty of Medicine—Professor Charteris.

QUALIFICATIONS GIVEN BY THE SCOTTISH COLLEGES.

The Royal College of Physicians of Edinburgh, the Royal College of Surgeons of Edinburgh, and the Royal Faculty of Physicians and Surgeons of Glasgow, conjointly confer the Triple Qualification (L.R.C.P.E., L.R.C.S.E., L.R.F.P.S.G.). Female candidates are admitted to the examinations for this qualification.

PRELIMINARY EXAMINATION.—This examination must be passed before the student commences professional study. It may be passed before any of the Boards recognised by the General Medical Council, and enumerated in the Regulations of the Colleges. The Educational Institute of Scotland conducts a qualifying Preliminary examination for medical students, in Edinburgh and Glasgow, on behalf of the Colleges. This examination embraces English, Latin, Mathematics, and either Greek, French, German, Italian, or other modern language. Calendar, containing examination papers, can be had from Mr George Pringle, M.A., 47 Moray Place, Edinburgh. Price 1s.

Before registration, the student must also pass an examination in Elementary Physics and Elementary Chemistry conducted or recognised by one of the Licensing Bodies.

PROFESSIONAL EDUCATION.—The curriculum must extend over five years. Graduates in Arts or Science of any recognised University who have spent a year in the study of Physics, Chemistry, and Biology, and have passed an examination in these subjects for the degrees in question, are exempted from the first year of study. The fifth year of study should be devoted to clinical work in one or more recognised Hospitals or Dispensaries, and to the study of special diseases. For information regarding the payment of class fees by the Carnegie Trust, *vide* p. ii.

The course of professional study is in conformity with the Regulations of the General Medical Council. Full particulars of the Curriculum, and the arrangements for examinations, may be obtained on application to Mr D. L. Eadie, 49 Lauriston Place, Edinburgh, or to Mr Walter Hurst, Faculty Hall, 242 St Vincent Street, Glasgow. Candidates should state date of medical registration.

PROFESSIONAL EXAMINATIONS.—Four of these are held during the curriculum. Each is held quarterly: for the ensuing period three times in Edinburgh and once in Glasgow. Candidates may enter for all or any of the subjects at the First, Second, and Third Examinations. In the Final Examination the subjects of Medicine, Surgery and Midwifery shall be taken together at the conclusion of five Winters and five Summers of Medical Study, provided that a period of twenty-four months has elapsed since passing the Second Professional Examination; and the subject of Medical Jurisprudence and Public Health may be taken at any time after passing the Third Examination. Candidates are advised to enter for the entire examinations.

Medical Education in Scotland

FEES FOR PROFESSIONAL EXAMINATIONS.

For each of the first three, £5 ; for the final, £15.

Fees for examinations *in Edinburgh* should be lodged with Mr D. L. Eadie, 49 Lauriston Place, and *in Glasgow* with Mr Walter Hurst, 242 St Vincent Street.

DIPLOMA IN PUBLIC HEALTH OF THE ROYAL COLLEGES.

The Diploma is granted by the Triple Qualification Board.

1. Every candidate for examination must hold a registrable medical qualification, which has been registered under the Medical Acts.

2. After obtaining such qualification he must have attended a recognised Laboratory in which Chemistry, Bacteriology, and the Pathology of the Diseases of Animals Transmissible to Man are taught ; and the certificate must show that the candidate has conducted Chemical and Bacteriological analyses of air, water, sewage and foods, and certify that the candidate has attended not less than four calendar months, and that he has worked in the Laboratory for at least 240 hours, of which not more than one-half shall be devoted to Practical Chemistry. The following are alternative arrangements for British Armies in the field :—

The Laboratory experience at a Base Hygiene Laboratory, when and so far as approved by the General Medical Council, shall count towards the four months' Laboratory course prescribed by the Council ; and Laboratory experience acquired by medical officers on the staff of hospitals for infectious diseases shall count for such part of the Laboratory course for the Diploma in Public Health as the Assistant Director for Medical Services (Sanitation) may recommend, and the General Medical Council on consideration may approve.

3. After obtaining a registrable qualification he must during six months (of which at least three months shall be distinct and separate from period of Laboratory instruction required) have been engaged in acquiring a practical knowledge of the duties of Public Health Administration for not less than sixty working days under the personal supervision of—

- (a) In England or Wales, the Medical Officer of Health of a County or single sanitary District having a population of not less than 50,000, or a Medical Officer of Health devoting his whole time to Public Health work ; or
- (b) In Scotland or Ireland, the Medical Officer of Health of a County or District or Districts with a population of not less than 30,000 ; or
- (c) In Ireland, a Medical Superintendent Officer of Health of a District or Districts having a population of not less than 30,000 ; or
- (d) In the British Dominions outside the United Kingdom, a Medical Officer of Health of a Sanitary District having a population of not less than 30,000, who himself holds a Registrable Diploma in Public Health ; or
- (e) A Medical Officer of Health who is also a Teacher in the Department of Public Health in a recognised Medical School.
- (f) A Sanitary Staff Officer of the Royal Army Medical Corps having charge of an Army Corps, District, Command, or Division recognised for the purpose by the General Medical Council. During the continuance of the war, Base Districts on Lines of Communication of a British Expeditionary Force will be recognised.

Qualifications given by the Scottish Colleges

4. After obtaining a medical qualification he must have attended for three months at least twice weekly the practice of a Hospital for Infectious Diseases, at which he has received instruction in the methods of administration.

The examination consists of two parts. The first part includes—(a) Laboratory work, with Chemistry and Bacteriology; (b) Physics and Meteorology.

The Second Examination embraces—(a) Report on premises visited; (b) Examination at Fever Hospital; (c) Examination at Public Abattoir; (d) Epidemiology and Endemiology; (e) Vital Statistics and Sanitary Law; (f) Practical Sanitation.

Each examination is held bi-annually, in October and May. The fee for each is £6, 6s.; for re-examination, £3, 3s. Fees and applications to be lodged with Mr D. L. Eadie, 49 Lauriston Place, Edinburgh; or with Mr Walter Hurst, 242 St Vincent Street, Glasgow.

Copies of new regulations applicable to candidates commencing curriculum after 1st January 1924 may be had on application.

MEMBERSHIP AND FELLOWSHIP OF THE ROYAL COLLEGE OF PHYSICIANS, EDINBURGH.

Every applicant for the *Membership* must possess a recognised qualification, and be not less than twenty-four years of age. He must pass an examination—

- (1) On the Principles and Practice of Medicine, including Therapeutics.
- (2) Also on one or more departments of Medicine specially professed, and approved by the Council, *in which a high standard of proficiency will be expected.*

The fee for the Membership is thirty-five guineas.

Members of not less than three years' standing may be raised by election to the *Fellowship*, the fee being thirty-eight guineas, exclusive of Stamp Duty of £25.

The Membership and Fellowship Diplomas are open to Women.

FELLOWSHIP OF THE ROYAL COLLEGE OF SURGEONS, EDINBURGH.

Every candidate must be twenty-five years of age, and must have been engaged for two years in the practice of his profession, after having obtained a recognised qualification in Surgery. The petition for examination must be signed by two Fellows—a proposer and seconder.

The candidate must pass an examination on Principles and Practice of Surgery, including Surgical Anatomy, Clinical Surgery, and any one of the optional subjects; Surgical Pathology and Operative Surgery, Ophthalmology, Laryngology, Otology and Rhinology, Gynecology, Obstetric Surgery, Anatomy, and Dental Surgery and Pathology. *Candidates are not allowed to appear more than three times at the examinations.* The Fellowship is conferred by election after examination.

The fee is £45, except the candidate be a Licentiate of the College, when the fee is £35. Further particulars may be obtained from the Clerk to the College, 49 Lauriston Place, Edinburgh.

The Fellowship Diploma is open to Women.

Medical Education in Scotland

HIGHER DIPLOMA IN DENTAL SURGERY.

The Royal College of Surgeons of Edinburgh grants a Higher Dental Diploma (H.D.D.) to candidates who have been engaged in study or practice as a Registered Dentist for at least one year subsequent to having obtained the Licence in Dental Surgery of the College, or a licence or qualification in Dental Surgery specially recognised by the College.

For candidates who are Licentiates in Dental Surgery of the College the fee is £15, 15s., for all other candidates £21.

Candidates are examined in the following branches of Dental Science and Practice:—

Dental Surgery, Anatomy. Pathology and Bacteriology, Prosthesis, Anæsthesia and Dental Radiology.

The examination is Clinical and Practical as well as Written and Oral.

Candidates are expected to show a high degree of knowledge and skill.

The Diploma is registrable in the Dentists' Register as an additional qualification.

The H.D.D. is open to Women.

FELLOWSHIP OF THE ROYAL FACULTY OF PHYSICIANS AND SURGEONS OF GLASGOW.

Every candidate must have been qualified for two years, and be aged twenty-four. Admission to the Fellowship is by examination and subsequent election. The candidate is examined on either (a) Medicine (including Clinical Medicine, Medical Pathology, and Therapeutics), or (b) Surgery (including Clinical Surgery, Operative Surgery, Surgical Anatomy, and Surgical Pathology); and on one optional subject—Anatomy, Physiology, Pathology, Bacteriology, Midwifery, Diseases of Women, Medical Jurisprudence, Ophthalmic Surgery, Aural, Laryngeal and Nasal Surgery, Dental Surgery, State Medicine, Psychiatry and Neurology, Dermatology, Specific Fevers, Diseases of Children, or Venereal Diseases and their Sequelæ.

The fee is £50, except the candidate be a Licentiate of the Faculty, when it is £40.

The Fellowship Diploma is open to Women.

Exhibition of Patients

features of an epithelioma developing in scar tissue, and was about the size of a half-crown.

Mr Shaw gave a brief description of the rôle played by the lymphatics in lupus, and described how the fragmentation of the lymphatic channels, which the lupus causes, serves to prevent the distant spread of an epithelioma developing at a later period. This was first fully demonstrated by Sampson Handley and is the explanation of the fortunate failure to disseminate to the glands which lupus carcinoma exhibits.

Treatment.—The ulcer was widely excised, and the skin stitched

The Transactions of the Medico-Chirurgical Society of Edinburgh

SESSION CVI.—1926-1927

THE TREATMENT OF LOCOMOTOR ATAXIA, WITH SPECIAL REFERENCE TO ATAXIA.*

By A. NINIAN BRUCE.

LOCOMOTOR ATAXIA (*tabes dorsalis*) was first described by Todd in England in 1847, and by Romberg in Germany in 1841-51, although Schermer had described the peculiar gait in 1819, and Decker in 1838 called attention to the swaying and unsteadiness with closed eyes; but the first important recognition of the disease as a clinical entity was in a paper by Duchenne of Boulogne published in 1857-58, in which he described the symptomatology under the heading of "ataxie locomotrice progressive." It is interesting to observe that in this early account of the disease the progressive character of the ataxia is noted. The cause of the condition soon became a subject of much speculation and controversy. Shock, injury, heredity, fatigue, and various other causes were all in turn suggested as causal factors. Erb and Mœbius strongly believed that the disease was syphilitic in origin, and this view was even more strongly asserted by Fournier. Hitzig, on the other hand, taught that it was the result of some toxin liberated from some unknown source as the result of accident.

The discovery of the *Spirochæte pallida* by Schaudinn, and its recognition as the cause of syphilis, renewed interest in the controversy. But the failure to find the spirochæte in the tabetic lesions, the lack of success of drug treatment directed against the spirochæte, and the fact that primary and secondary manifestations of syphilis are so often absent, all failed to lend support to the purely syphilitic origin of the disease, many influential authorities considered that tabes could occur quite apart from syphilis, and some even went so far as to assert that when tabes and syphilis were both present in the same individual, the association was accidental and of no causal significance. At the same time another group of observers were inclined to

* Read 4th May 1927.

Treatment of Locomotor Ataxia

suspect that if the spirochæte was not the cause of the disease, a toxin resulting from the activity of the syphilitic spirochæte was responsible.

The introduction of the Wassermann reaction and the fact that a positive result always denoted syphilis, although its absence did not preclude it, threw further light on this subject as it was discovered that the number of tabetics in whom this reaction was positive, varied from 90 to 100 per cent.

Finer and more modern histological methods have proved that the lesion involves the sensory neurons of the spinal cord. These appear to degenerate as the result of some process at work outside the cord itself. It is not due to chronic meningitis (thickening of the pia mater), because this is not found in all cases, and in the early stages of tabes the meninges often appear normal. Nageotte considers that tabes is the result of a localised lesion of the posterior roots between the dura mater and the posterior root ganglion, that the changes extend sometimes as far as the ganglion, and that the lesion is a *transverse interstitial neuritis of the posterior root fibres*. Orr and Rows regard tabes as "a system lesion, which begins as a parenchymatous degeneration of the sensory protoneurons starting at the point where the neurilemma (or external sheath) is lost." This is just about the place where the posterior root fibres pass through the pia mater. Marie and Guillain consider that there is a syphilitic lymphangitis of the posterior system of the lymphatics of the spinal cord. This system of lymphatics does not communicate with the lymphatics of the lateral and anterior columns. The lymph streams ascend in the posterior column of the spinal cord; and there is a common lymph system for the posterior roots, posterior columns and the posterior pia mater. The lymph circulates in the perivascular lymphatic spaces, and ascends the posterior roots to reach the spinal cord. Hence infection more readily reaches the spinal cord by the posterior roots than by the anterior roots where the lymph flow is outwards. Noguchi has been able to demonstrate the spirochæte in these tabetic lesions and to make cultures from them. And as no organism, apart from the spirochæte has been isolated from inflammatory tabetic foci, the evidence is clear that as syphilis is always present, it has

A. Ninian Bruce

a causal relationship and that the spirochæte must be regarded as the exciting organism.

This brings us to the problem why it is that only a proportion of those who suffer from syphilis develop tabes. When an infection is general the tissues are equally accessible. The tissue attacked must thus be that which affords the most favourable soil for the growth of the infecting spirochæte. The spirochæte in a new host grows best in the same tissue as that from which it is derived, as the biochemical reactions of the same tissues in the two hosts must be identical. A spirochæte growing only in the nervous system of one host not uncommonly gives rise to an infection of a second host where only the central nervous system is attacked. The strain of spirochæte is thus somewhat specific for the tissue in which it grows and which it invades. McDonagh and Ross go so far as to state that these strains may be morphologically identified, but Noguchi and others deny this. A spirochæte which has adapted itself to the biochemical conditions in the nervous system as in tabes appears to lose its capacity to attack other tissues, such as the skin and mucous membranes and deeper tissues, as such lesions are the exception in tabes, or at least such strains only grow with difficulty in such situations where the biochemical conditions are different. A particular tissue in one host may thus acquire immunity to a particular strain, and this immunity may apply not only to the host where the successful defence was established but in any freshly infected host. Thus we get an explanation why syphilis of the central nervous system is so commonly considered to be non-infective. That special strains of spirochæte exist is proved by the example recorded by Pierre Marie and others of recurrences of tabes and general paralysis in the same family, or at least traceable to a common infection. It is also to be noted that there is a tendency for the cardio-vascular system to be attacked at the same time as the nervous system, for instance, aortic lesions not uncommonly accompany tabes; among ninety-nine tabetics Matsunaga found fifteen cases of cardiac disease. Cardio-vascular lesions are in fact one of the important causes of death in tabes. The longer the active period of the invasion lasts the less the primary tends to be the sole site.

The involvement of the posterior sensory fibres leads to

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disturbance of the reflex arc with loss of knee-jerks and other reflexes depending on the particular root involved. As a rule, before destruction of these fibres takes place, there is a period of irritation, so that exaggeration of reflex action usually precedes loss, but this period may be of very brief duration and is often overlooked. The so-called "lightning" pains develop at this time. Interference with the reflex arc result in hypotonia, the muscles tend less and less to resist stretching and allow unusual degrees of flexion and extension.

The posterior roots, however, not only carry sensory impulses centralwards, they also carry vaso-dilator impulses peripheralwards. The sensory nerve fibres at the periphery of the body bifurcate, one branch passing to the sensory end organ, the other branch ending in a blood-vessel. The hyperæmia which ushers in the whole process of the inflammatory reaction, result from an axon reflex limited to the two branches of this terminal bifurcation. Section of a sensory nerve does not interfere with this reaction, but if sufficient time elapses to allow the peripheral divided portion of the fibre to degenerate then this hyperæmic reaction cannot occur, and immediate death of the tissue occurs following injury. Thus perforating ulcers and other trophic phenomena are characteristic of tabes, and the swelling of joints, termed "Charcot's" joints, which are painless, is another example of the same condition. Although the afferent nerve roots carry sensory impulses centralwards only a small proportion of these enter consciousness as sensations of pain, touch, heat or cold. A large proportion of the afferent impulses are concerned with posture and remain on the physiological level. These arise from nerve fibres terminating in the tendons, muscles and joints.

But the main symptom with which we are concerned this evening is the ataxia. Ataxia, as a rule, develops gradually and insidiously. The tabetic begins to find he is not so sure of himself when he shuts his eyes, he tends to fall into the basin when he washes his face, he is no longer so certain where the ground is, and he becomes unsteady in his movements. Walking downstairs begins to present unusual difficulties and he becomes quickly fatigued. His uncertainty in movement necessitates great care in walking and he has to watch everything he does. These difficulties increase and he begins to

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find his movements becoming more and more awkward, jerky, and difficult. This inco-ordination increases until the whole process becomes chaotic. Later, the problem of movement becomes so difficult and complex that the tabetic surrenders to what he regards as the inevitable, and he leads an existence restricted at first to an arm-chair and later to bed. Hence the classification of tabes into the three divisions of (1) the preataxic, (2) the ataxic, and (3) the "paralytic" stages.

Ataxia, although usually of slow and gradual development, may develop suddenly. Dr James Taylor had a tabetic under his care at the National Hospital, London, who, while on duty as a policeman, captured a criminal after a severe and exhausting chase, but once he had captured the man he became suddenly so acutely ataxic that he had to be carried to hospital there and then. Maloney has pointed out that ataxia may develop acutely, not only following excessive fatigue but also from fear, and he records the case of an elderly man who, when visiting an underground cave lit by electricity, felt frightened at being so far under the earth alone with strangers. Suddenly the electric light failed and his worst fears seemed to be confirmed. He collapsed, had to be carried out of the cave to a local hospital where he was found to be a typical tabetic with an incapacitating degree of ataxia. Maloney has called this the *ataxic moment*, i.e. the moment when ataxia appears suddenly; at a definite moment before this movement is apparently normal, after this it is chaotic. The cause is obviously the state of fear or fatigue which immediately preceded it, without which it would have developed gradually and slowly in all probability. Clearly there is no question of a sudden increase in the extent of the lesion. It is an immediate effect and entirely mental.

The importance of this acute onset of ataxia is the fact that it is mental in origin, and thus it enables us to realise that possibly when the ataxia is slow and gradual in onset it may also simply be because the change in the mental outlook is slower in taking place. The onset and increase of ataxia has no relationship to any increase in the organic lesion in the posterior roots. A tabetic in the pre-ataxic stage may pass on to the ataxic stage and even to the "paralytic" stage without

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any increase in the content of the syphilitic processes involving his posterior roots. All that is happening is that he is changing his mental outlook in relation to his walking and a progressive mental deterioration is setting in.

The influence of the mental state on posture is well known. The difference in attitude of the tired from the vigorous, of the depressed from the excited, and of the frightened from the courageous is obvious. And in addition we are accustomed to use words to describe mental states from their resultant attitudes, such as "spine-less," "weak-kneed," "lacking in backbone," "upright," etc.

The effect of blindness on ataxic tabetics is remarkable, as a blind tabetic is usually not ataxic. Blindness is stated to accompany tabes in only about 8 per cent. of the cases, and thus the opportunities to observe the effect of blindness are not numerous, especially as the blindness may develop before the ataxia. A blind tabetic does not usually become ataxic, and an ataxic tabetic who becomes blind readily and frequently loses his ataxia. Benedikt of Vienna, in 1881, asserted that tabes associated with rapid optic atrophy shows benign spinal symptoms, and in 1887 he proclaimed a *law* that the specific motor symptoms of tabes would diminish in severity immediately the disease became complicated by optic atrophy, no matter how advanced these symptoms might be, and he also asserted that he knew of no exception to this law. That improvement and even disappearance of ataxia may occur following the onset of blindness has been confirmed by many observers. According to Mott 50 per cent. of cases with optic atrophy later develop general paralysis of the insane which takes them out of the category of tabes. The fact that ataxia may disappear with the onset of blindness is important in enabling us to understand the nature of the mental change which results in ataxia. Blindness simplifies the mental life as it cuts out visual images. The blind tabetic leads a life of enforced inaction. He only reacts to such simple reflex problems as are able to penetrate his restricted life. He thus worries less, and he is less fatigued.

When the seeing tabetic begins to find that his postural images are beginning to mislead him, and that he is beginning to fail to localise exactly where his limbs are in space, he

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substitutes for these postural images visual images, and in this way is able to get the information he requires. But the substitution of a visual image for a postural image throws the whole spinal reflex integration out of gear, and is the substitution of an inefficient for an efficient method, of a complex integrative action for a simpler one, and the ataxia is the symptom of the resultant muscular inco-ordination.

When a seeing tabetic recognises that his postural images are misleading, and commences to rely upon visual images in their place, his next tendency is to repress these misleading postural images as far as he can. Just as a case of diplopia finds two visual images misleading, and finally adjusts himself by repressing the false image, so the tabetic attempts to make a similar adjustment, but in this case the final result is not so successful, as unfortunately it is the true or postural image which is repressed.

Movements are originally learned by watching the earlier attempts and controlling and directing them by vision. If the movement is not exactly what is intended, the error is seen, recognised and corrected. By concentrating attention on these various postures we gradually learn to associate a postural image with each position, and with repetition and practice we learn to know from postural information alone the position of any part of the body in space. As these movements become more and more established, visual control is unnecessary and superfluous, and is finally dispensed with and remains in reserve, only to be called into service if required. The more visual direction is utilised, the more the mental effort required, and the greater the resultant fatigue.

Postural reflex control of movement is more efficient than visual control because postural control is effected at the physiological level, and is not subject to the same degree of fatigue as visual or conscious control which is effected at the psychological level. It is a simpler reflex integration and is therefore more efficient. A substitution of visual for postural control is thus a retrogression and a return to a more primitive and cruder arrangement. It is a conscious process substituted for an unconscious.

Visual stimuli far outnumber all the other sensory stimuli

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from the sensory fields. They thus excite far more associations than any other tactile, auditory or sensory image. Effortless attention is largely characteristic of vision. This external distraction and competition of visual images for attention makes it necessary to minimise their influence. Hence tea-tasters and wine connoisseurs close their eyes, when they wish to appreciate a flavour, as they smell or taste. An expert pianist keeps his eyes fixed on his music and allows his fingers to wander up and down the keyboard of the piano controlled only by postural information. A good shot keeps his eyes on the bird and brings his gun into line entirely by posture. In golf, the reason we are told to keep our eye on the ball is so that there may be fixation of the visual image. The swing may then be carried out entirely by postural information. Removal of the eye from the object on which it is fixed in the above movements immediately throws the automatic co-ordinated muscular action out of gear and a disintegration of the reflex pathways occurs with resulting chaos. Thus in the tabetic, the substitution of visual images for postural images in walking results in inco-ordination and chaos. Once this substitution is made, attempts to repress the postural images lead to an aggravation of the condition until the arrangement become unworkable and the tabetic takes to bed.

The reason why blindness in tabes is rarely accompanied by ataxia is because a tabetic who is blind is unable to make a substitution of postural images by visual images, and thus is forced to rely solely upon his postural images. If he becomes blind in the pre-ataxic stage the ataxic stage will not develop, and if he becomes blind after the ataxic stage is present he is forced to re-learn his postural images and thus his ataxia disappears.

Postural images may be developed if special attention be directed to this particular end. Jugglers and acrobats require to do this, and are obviously successful. But probably no better example or illustration could be suggested than that of Blondin who was able to walk across the Falls of Niagara on a tight-rope.

The line of treatment for ataxia is thus evident. The ataxic tabetic has found his postural information diminished

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and delayed by the lesion in the posterior root. The sensory impulses are fewer, feebler and misleading. He becomes conscious that his information of posture is erroneous, that his gait is becoming clumsy and awkward in consequence, and that his equilibrium is affected. He attempts to substitute visual information for the misleading postural information, and finally tends to repress this latter altogether. He throws out of gear his whole integrative pathways, substitutes a more complex one in its place, changes an unconscious physiological process into a conscious psychological one, with resulting disintegration of nervous function. But all this time no further structural change is taking place necessarily in his posterior roots. The organic lesion may be just the same in the pre-ataxic stage as in the ataxic or paralytic stages. All that is happening is a progressive mental deterioration which is running its course independently of the organic lesion which was responsible for originating the condition and which itself may be very largely stationary.

Treatment obviously requires (1) removing the dependence on visual images, and (2) re-learning the postural images. To a large extent treatment has thus to be directed towards improving the mental state. Visual images may be cut out by blindfolding the patient, but this is not always necessary. He must not however be allowed to watch his movements. The presence of Romberg's sign and the commencement of ataxia are to be regarded as signs that inadequate mental control over movement has set in. If this mental factor is clearly understood and the necessary mental treatment given in the pre-ataxic stage, ataxia need never develop, except as the result of some sudden calamity. The treatment in the pre-ataxic stage consists of an endeavour to prevent the patient from having to undergo any acute mental stress, to limit his capacity of action to what his mental energy will permit, to prevent fatigue, and to establish complete and proper mental control of all his doings and movements.

A tabetic who, however, has progressed to the ataxic stage is merely a tabetic whose mental stage has deteriorated below the level for effective action, who has begun to lose confidence in his postural images and is trying to substitute for them visual images. This complication in his reflex

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paths, however, completely deranges all his old landmarks, and every movement merely tends to decompose further his mental state. As the more he walks the worse his ataxia becomes, he becomes dull and depressed, as it is difficult to see how a symptom which is constantly being aggravated can be cured.

When standing, the average tabetic stands with his feet wide apart and with his heels closer together than his toes. His weight is largely placed on his heels and the toes tend to cling to the ground. The antero-posterior and transverse arches give way and the hypotonic muscles elongate. Such a foot affords a most inadequate basis for support. The only stable element in it is the os calcis, and the rest of the foot may move as a flail attached to the ankle and be little better than a flabby conglomeration of bones and muscles. The ligaments stretch beyond functional utility. This unusual distribution of the weight of the body on the heel and clutching of the ground with the toes, leads to blisters and perforating ulcers if the ordinary healthy trophic functions of the tissues are impaired. Needless to say, the lack of support and stability which such a stance causes in addition to his tabetic swaying results in uncertainty and fear. Every step is accompanied by a lavish expenditure of muscular and nervous energy out of all proportion to what the situation demands and rapidly produces fatigue. Thus his troubles multiply and he goes from bad to worse.

The normal position for the feet in standing is when each external malleolus is in the same vertical plane as the great trochanter, and the long axis of each foot directed forward with the feet more or less parallel. In this position the weight of the body is distributed across the longitudinal and transverse arches and is directly transmitted to the ground by a tripod, consisting of (the internal tubercle of) the os calcis, the sesamoid bones and head of the first metatarsal and the base of the fifth metatarsal. The tabetic foot must be so supported that the weight is distributed in the above manner on this tripod, and for this purpose a cast of the foot is taken first at rest and second with the full weight of the body on it, so that the exact points upon which the weight is falling, the degree the natural arches have given way and the amount of spread in all

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directions permitted by the overstretched muscles and ligaments may be understood. From these a special boot is made which corrects these faults and supplies the support properly on to the normal pressure points. The patient now can use his whole foot and not merely his heel as a support and immediate relief is experienced. He feels he has a secure and rigid base. He is more stable, and feels it. He re-learns his postural images for his feet. He fears less, and as fear begets ataxia and ataxia begets fear, his increased reassurance improves his gait. This artificial support to the foot is merely a temporary expediency until his own muscles and ligaments recover their tone by appropriate exercises.

A record of the gait is best taken on paper, the feet being dipped in potassium permanganate and his walking-stick, if used, has some wool at the point also so dipped. This will give us an indication and measurement of the degree of ataxia present.

Next we must consider the fact that most of the muscles of the limbs and body are also in a hypotonic state and need support until they also are strengthened. Abnormal mobility of joints must therefore be prevented. The restricting apparatus must be light, and a simple belt or bandage is all that is required. It is simply asked to perform the duty of a temporary artificial muscle. The extent and mode of application varies with each case. For abduction and outward rotation of the leg a bandage attached to a loop at the back of the boot is carried several times spirally round the leg and attached to a belt at the waist. A corset may be considered in some cases.

A series of graduated postural exercises are now required to enable the tabetic to re-learn his postural images. A mental state as free from external and internal distractions as possible must be created. Blindfolding may be necessary to achieve the first object, although this can often be omitted. As regards internal distraction, the most important factors to eliminate are fear and fatigue. The confidence of the patient must be established, and at first he will tend to rely largely upon his teacher. Exercises must be carefully controlled and must be followed by rest and recuperation. The first necessity is to discover a position in which the relationship of the body

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to its environment is stable. This can almost always be found in the sitting attitude. Various movements and exercises can be performed under these conditions without fear on the part of the patient and can be repeated until practice has made them perfect. He now proceeds to the creeping *or* "all-fours" position. The amount of support required is usually not very great, because there are four points of support and in a very short time movement along the floor soon becomes easy. The head should be held well up so that movements are carried out without watching each action.

After stability and movement in the creeping position is learned, kneeling is the next advance. The head must be held erect and usually safety in the kneeling position is soon established. The walking on the knee is practised (if necessary with suitable knee-caps). This stage is usually not of long duration as it presents no great risk to the performer since he can assume the all-fours position if his balance is lost. Next he tries standing in a corner with the support of both walls. He then has to practise a series of movements of his limbs until he feels some return of confidence and has repeated every posture until it has become effortless. The series of postural images which accompany each movement must be completely re-learned. Then he can stand facing the wall, and, touching it with his hands, he moves sideways along the room. Then he can turn his back to the wall and make the same movement, both with his eyes shut and with them open. He then can make attempts to cross from one wall to the other at the corner of the room. Any return of loss of balance indicates some postural image has not been satisfactorily learned, and he must practise this over and over again until this is again learned. He can then be taught to walk about the room, first with help, second without it, to kneel down and rise up in the middle of the room away from support, to go upstairs and then downstairs, to lengthen his distance, to discard his walking-stick and finally to move about with confidence unaided in public.

No matter how advanced the degree of ataxia, improvement is quick along these lines, provided the tabetic is free from organic mental disease. The importance and significance of the

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mental factor is very strikingly thrust upon anyone attempting this method of cure. As a rule improvement is rapid, and it is specially to be observed how pain and other symptoms may diminish and disappear as freedom of movement returns. The mental relief is enormous.

Tabes is a disease which does not as a rule shorten life. In the absence of complications the life of a tabetic may almost be regarded as of average duration. The great incapacitating factor is the progressive development of the ataxia. If we are now able to prevent the development of this symptom, and to cure it if it does appear, as we now are able to do, then we practically restore the tabetic to a more or less normal existence. The treatment of the ataxic tabetic differs in no way from that of the pre-ataxic tabetic, and as the greater part of this treatment consists of the prevention of a progressive mental deterioration and demoralisation, such treatment is more or less comparable to the treatment of the syphilitic neurasthenic.

In conclusion, attention has to be drawn to the failure of metallic injections to kill the spirochæte in the central nervous system, and at best such methods of treatment can only be regarded as an attempt to reinforce the natural defence reactions of the tissues. There is too great a tendency at the present moment to direct attention to the spirochæte and too little to the host. Antisyphilitic remedies are pushed in an attempt to replace natural human defence reactions rather than to assist them. What is wanted is rather to strengthen and develop the natural defensive reactions of the tissues. But the important point is that although tabes is recognised universally as a syphilitic disease; even if antisyphilitic treatment could be successful in killing the spirochæte, such a result would have no benefit in curing tabetic ataxia because this is not primarily a direct effect of the syphilitic lesion. It is an indirect and secondary reaction due to a disturbance of the normal integrative action of the nervous system which has no proportionate relationship to the underlying organic syphilitic condition. It is a mental condition and requires mental treatment.

It has also to be noted that the understanding of the nature of ataxia and its essential prevention and curability, makes the

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classification of tabes into the pre-ataxic, the ataxic, and the paralytic stages no longer necessary. This is a classification based on symptoms and was useful in defining the usual progress of the disease. It has served its day and generation, until the advance of knowledge of the integrative action of the nervous system allows us to dispense with it. The true organic lesion in tabes appears to be a syphilitic interstitial neuritis of the posterior roots.

Tabes is an excellent example of the fact that recent investigations on the physiology of the central nervous system make it necessary for us to orientate ourselves anew in relation to nervous diseases and their symptoms. These symptoms must be interpreted with the aid of this new knowledge and treated in accordance with this new interpretation. In tabes we have a definite organic lesion producing certain structural defects and leading to certain physiological and psychological consequences. These physiological consequences bear no relation to the extent of the organic lesion and progress while the organic lesion may remain stationary. There is thus a definite divorce between the extent of the symptoms and the extent of the lesion. These symptoms may react to proper physiological or psychological treatment, and the results may appear marvellous. A neglect to realise and appreciate this relationship between symptoms and mental states, and a consequent failure to give relief, may result in such patients finding their way into the hands of the unauthorised who, ignorant of the source of symptoms, but able to influence the mental state, may be able to bring relief where misguided medical efforts have proved unavailing. What would appear to be required is that the patient must be taught through adequate mental training to defend himself against the tyranny of symptoms and to exert efficient mental control over his mental processes.

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DISCUSSION.

Professor Bramwell said—Tabes was one of the diseases of the moment when I was studying in Paris nearly thirty years ago. Indeed the mention of tabes in the Neurological Society of Paris brought half the members to their feet. The controversies on various points were very keen and it is even reported that one member of the Society challenged another to a duel since he believed that he had not received credit for priority in relation to a certain observation. I have listened with much interest to Dr Bruce's remarks with reference to the axonal reflexes and to the part postural images play in relation to the ataxia.

Cases of tabes with pronounced ataxia, which were comparatively frequent twenty or thirty years ago, are, I venture to think, but seldom seen nowadays either in the medical wards or in those set apart for venereal disease. This is certainly my impression and I think it must be a very general experience. Assuming this to be a fact, it is difficult to avoid the conclusion that the explanation is to be found in the introduction of the arsenical preparations and the more thorough treatment of syphilis in its early stages. Dr Bruce has referred to the ataxia as the most disabling symptom of the disease. While I agree that pronounced ataxia is a very disabling symptom, there are other symptoms, such as the gastric crises, the arthropathies and severe pains, which are at least as disabling and at the same time less amenable to treatment than is the ataxia.

Dr Bruce has given us a very lucid exposition of the mechanism by which the ataxia is produced, but I would protest against the statement in the epitome of his paper as to the "failure of Frenkel's exercises to cure ataxia." In 1900 I had the opportunity of seeing something of Frenkel and his treatment of ataxia by co-ordinated exercises, and I believe that I was one of the first, if not the first, to introduce the method into this country. Frenkel's observation, that when a tabetic repeats a movement several times his co-ordination improves, was the origin of the treatment, the proffered explanation being that with the répétition of a movement the patient comes to learn the position of his limb by means of the nerve impulses carried by the afferent fibres which are still intact. I have treated many cases by this method and there can be no question that great improvement in the ataxia, corresponding very closely with the trouble taken by the physician and the patient's perseverance, may be predicted in every case, provided that the treatment is not interfered with by severe pains or crises, by a disabling arthropathy, or by mental deterioration.

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I am glad that Dr Bruce has emphasised the mental factor in relation to the ataxia. There can be no doubt that it is very important. When twenty-five years ago I wrote a paper on the treatment of tabes by Frenkel's exercises, I was under the impression that the ataxia was to be explained by defective impressions received from the periphery, but further experience has convinced me that there is often a large mental element which varies greatly in different cases. Perhaps the best illustration of this fact is to be found in instances such as Dr Bruce has mentioned, in which the patient suddenly becomes ataxic. It is inconceivable that in these cases the suddenly developed ataxia is a result of an acute organic lesion. There is often a history of a fall or of an emotional factor immediately preceding the aggravation of the ataxia and one is forced to the conclusion that the sudden increase in the ataxia is a direct consequence of loss of confidence. A fall, for instance, disturbs the patient's confidence, just as when one is learning to skate and has a fall one's confidence is shaken. The explanation must be found, as Dr Bruce has suggested, in a physiological disturbance of the postural mechanism.

As regards the question of antisyphilitic treatment. Every case must be considered as an individual problem. Cases of tabes are met with in which the condition appears to be absolutely stationary. Under such circumstances I do not think that it is necessary to emphasise the fact, if the patient does not already know it, that the disease is the result of syphilis and to advocate antisyphilitic treatment for one may thereby produce a state of misery which more than counterbalances any benefit which may be expected to result from the therapeutic procedure. In other words, the personality and mental attitude of the patient must be taken into account in every instance.

Dr Robert A. Fleming said—I agree that one rarely sees the marked cases of tabes with ataxia which one remembers in days gone by. It is a gratifying fact if it means that such cases are less common because the disease is more efficiently treated than it used to be. I noted that Dr Bruce refers to the pre-tabetic stage of the disease in his synopsis, but did not state what he meant by it in the paper. I presume he implies the earliest stages of the disease before any of the marked phenomena develop? To my mind this is a most important stage because it is then that one has the best chance of arresting the disease by vigorous treatment. I have noted in certain cases the altered zones of sensation to pain described by Gordon Holmes which may be found at the upper part of the chest. In my wards I had recently just such an early case, and these zones were helpful in enabling the patient to

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be energetically treated. The colloidal gold reaction gave in that instance a definite luetic response. I think one would be more than justified in prompt treatment with one of arsenical preparations in every early case, and certainly without any fear if there were no evidence of any optic atrophy being present. I agree with Dr Bruce that the terms pre-ataxic and ataxic do not help in describing the so-called stages of locomotor ataxia. I should like to say something in support of the value of Frenkel's exercises which Dr Bruce criticises. I have carried out this method of treatment in many cases of ataxia both in tabes and disseminated sclerosis. In all of these I use sight greatly and I was somewhat disturbed to hear Dr Bruce's denunciation of a method I had so long practised. I always insist on the patient slowly and carefully carrying out certain movements of legs or arms using his eyes in the process. In the case of the legs I then make him try to walk with the go-cart or some supporting apparatus, using his eyes to acquire again the postural movements he has lost. Once he has learnt to walk I make him look up to the ceiling so that he learns to dispense with his visual help. This method has yielded such excellent results in my hands that I do not feel convinced that sight is a mistake in the re-education of ataxic patients. I admit that the often-stated fact that tabetic patients who lose their sight from optic atrophy do not become ataxic. This made me listen with interest to Dr Bruce's paper, because it made me question whether sight is as desirable a factor in the treatment of ataxia as I have always in the past considered it.

I note Dr Bruce refers to patients who have become blind in cases of tabes becoming ataxic if they regain their sight. I do not believe that any tabetic who develops primary optic atrophy ever can recover his sight although it may be possible for a tabetic who has temporarily lost his sight as a purely functional condition to regain it. Such cases are and must be very rare.

Mr Lees said—There are several statements which Dr Bruce has made in the course of his paper with which I am not in complete agreement. He spoke of the ætiology of tabes and expressed the view that it was due to a neurotropic type of *Spirochæta pallida* as opposed to a dermatropic type. He quoted in support of this view the fact that in many cases of established tabes there was no history of either a primary sore or a skin rash. This argument is a rather flimsy one as the history is often unreliable in such cases and not infrequently we find on careful clinical examination definite evidence of the scar of a primary lesion, while in other cases, a history of gonococcal infection is admitted and this condition in such cases may often have masked a

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meatal or a urethral chancre. Few bacteriologists accept the view that there are different types of *Spirochaeta pallida*. The question of there being a neurotropic virus was fully debated some years ago and the protagonists of this theory failed completely to establish a case for it. Speaking from actual clinical cases, there are numerous cases met with in which it is impossible to explain why one patient should have nerve syphilis and another somatic syphilis.

At the present moment I have under my care a family of six children suffering from inherited syphilis. The father died of G.P.I.; the mother suffers from somatic syphilis; one of the children is a juvenile G.P.I., the other five all suffer from varying forms of somatic syphilis such as interstitial keratitis, osteomyelitis and paroxysmal hæmoglobinuria. There are many other cases one could quote to the same effect against there being a neurotropic strain of *Spirochaeta pallida*.

Secondly, I should like to join issue with Dr Bruce on the statement he made that there was evidence to show that salvarsan treatment had increased the incidence of nerve syphilis. The reverse is more true; this loose statement was made a few years ago by a prominent neurologist and was completely refuted by the evidence collected by Colonel Harrison. The statement made was that the treatment given in the army, an average of 4 to 5 grammes of "914," had given rise to an increase of neurosyphilis in those particular cases. Every clinic carrying out antisyphilitic treatment was circularised and all cases of ex-soldiers were investigated with the result that the incidence of neurosyphilis was found in these special cases to be almost a negligible figure. When we consider that the average amount of treatment then given in the army was necessarily dependent on the exigencies of the campaign and was not considered complete, the true facts brought out by Harrison are remarkable and completely contradict such statements regarding salvarsan which are made without any valid proof.

There is definite evidence, however, that lack of salvarsan and bismuth or mercury treatment will increase the incidence of neurosyphilis. The amount of treatment given to patients suffering from syphilis by medical practitioners throughout England is quite inadequate. On an average it is less than 2 grammes of the drug "914" per patient and yet the most experienced syphilologists and neurologists are of opinion that any case of syphilis, however early seen, requires a minimum of 8 to 9 grammes of "914" and with it at least 30 grammes of bismuth or the equivalent of 60 grammes of metallic mercury.

If neurosyphilis develops lack of salvarsan should be blamed and

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not the drug itself. Dr Bruce laid emphasis on the failure of salvarsan drugs to cure tabes dorsalis. Tabes is only one of the end-results of syphilis and that the true treatment of it should be the preventive treatment. If all cases of syphilis are diagnosed and treated in the seronegative stage of syphilis, before the development of a positive Wassermann and if treatment is continued for a sufficiently long period, I have no doubt whatever that tabes will become a very rare condition, much more rare than even Professor Bramwell and Dr Fleming find it now.

In addition, nerve syphilis can be diagnosed early when it is still an inflammatory lesion and curable, if every case of syphilis, while under treatment, is watched both clinically and serologically and if it is remembered that the time of infection of the nervous tissues is during the generalisation stage of the syphilis when 20 to 30 per cent. of all cases of syphilis show some pathological change in their spinal fluid. In this early inflammatory stage much can be done for them. I was glad to hear Professor Bramwell emphasise the importance of observing clinical signs and symptoms in cases of syphilis and of not relying only on highly scientific tests such as the Wassermann test. Every patient who is under treatment for syphilis requires periodic clinical observation even if he feels well and his blood gives a negative Wassermann reaction. If there is even the slightest clinical sign of nerve involvement the spinal fluid should be examined at once. In addition, it is advisable in every case of syphilis to examine the cerebro-spinal fluid at the end of the first year and also before the patient is discharged as cured. When this is carried out and cases of syphilis are kept under clinical observation there are few cases of tabes that will not be diagnosed in the early pre-tabetic stage when they are curable. The question raised by Professor Bramwell as to whether we should treat all cases and especially quiescent cases of tabes is a very difficult one. It is rare in syphilis to find only one part of the body, such as the posterior nerve roots, to be involved. There may be and often is an aortitis, myocarditis or some other lesion. We must consider every case on its merits and decide whether the lesions elsewhere are not progressive and in need of treatment even if the tabes is quiescent. I agree with what Dr Bruce and others have said about the importance of treating the mental state in all cases of tabes. There is a big mental strain in every case of syphilis and syphilophobia is often much more difficult to deal with than syphilis. Everyone of these patients require encouragement and as favourable a prognosis as it is possible to give.

Dr Bruce, in speaking of the failure of drugs in the treatment of cases of tabes, mentioned that salvarsan possibly damaged the natural

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defensive mechanism of the patient against syphilis. Over-treatment may do so but careful dosage in any case of syphilis tends to do the opposite, as seen in the feeling of well-being, the increase of weight, and the physical improvement that is apparent in patients having salvarsan treatment. In addition, we have now at our disposal in cases of nerve syphilis arsenical drugs such as tryparsamide which do not act as strong treponemacidal agents and exercise only a slight influence on the Wassermann test, but which undoubtedly increase the defensive mechanism of the body and stimulate the patient's resistance. If a case of nerve syphilis is diagnosed in the early inflammatory stages and this drug is exhibited before gross damage has been done to the nervous tissues then a great deal can be done to retard the progress of the disease and assist the patient. In any case in which ataxia has developed, antisyphilitic treatment alone is of limited value unless in conjunction with it we give the patient the benefit of courses of Frankel's exercises. I have seen marked benefit from combining the two methods, re-education of the muscles and antisyphilitic treatment.

The lucid exposition of the methods advocated by Dr Bruce for dealing with ataxia interested me very much and I shall be very glad to apply the methods he has outlined and watch their effect in some of the cases which come under my care.

Dr Traquair asked whether recovery or improvement ever took place in optic atrophy in cases of tabes. He questioned the view that signs of optic atrophy or other changes in the fundus oculi contraindicated treatment by tryparsamide and suggested that, so far from this being the case, such evidence constituted an added indication for this treatment.

Dr Webster said—I think that the very pronounced cases of locomotor ataxia that we used to see were always alcoholic, and that seems to let us see into the cause of the nervous symptoms. The whole system seems to be upset, by some inflammatory process attacking the fibrous tissue, for which the spirochæte has a predilection. I believe the nervous symptoms are due to slight affection of the covering of the nerves which upsets the arc and root of the reflex, and the whole system seems to be disturbed, more so when the tissues are lowered by alcohol. If tabes develop, I have found it useful to teach the patients themselves to massage their extensor muscles—not the flexor muscles, they are strong enough to look after themselves—but the extensor muscles have lost their tone. The reflex massage of the extensor muscles will correct those symptoms which we often find in paralytic cases.

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Professor Russell said—Personally, I am very grateful to Dr Ninian Bruce for coming here to-night. I am responsible for prompting him to come, and I thank him. I am sure you all agree that the way in which he expressed his view of the pathology and development of locomotor ataxia was both lucid and beautiful. I was particularly charmed with his dealing with visual images and with postural and other images and travelling by the sensory tract and his picture of cerebral reflex disintegration, and of the recovery of the postural impression and the re-establishment in that way of physiological function, and loss of ataxia.

I was interested in the remarks made by subsequent speakers, in regard to the decrease in the number of cases of locomotor ataxia that we see, and the idea I got from the speakers was that this was the result of modern treatment. I may, of course, have misunderstood, but as it is not so very long since the spirochæte was discovered, and modern treatment followed upon that discovery, then the modern treatment can hardly be the explanation. Still I am quite sure we don't see so many. In an institution I have to deal with, I used almost always to have two or three chronic cases, and I have not had one for years. That is quite in keeping with the observations that have been made to-night, but I don't myself quite understand the cause of it. It does not seem to me that the explanation lies entirely in the newer treatment, because the newer treatment has been too recent.

With regard to treatment, I was interested in the somewhat cross opinions which have been expressed. I am not in a position to judge between these expressions of opinion on the treatment that should be adopted in these cases and therefore I leave it alone, although I am, of course, interested in the observations which Mr Lees has made in his own special department, and I think we would all have been glad if the speakers who have taken part to-night could have laid down more definitely the value of the modern specific treatment of tabes, I am not in a position to judge and I think it has not been in use long enough for anyone to be certain of its value. It is an extraordinarily difficult subject in connection with life insurance—as to how you are to regard a proposer who has had syphilis and who has been treated by modern antisyphilitic methods and a positive Wassermann has become negative. How exactly are we, who have to do with insurance cases, to deal with cases of this kind? Are they to be taken as cases that are as good as cases that have not had syphilis? Then we have the unpleasant suggestion made by Dr Bruce that this modern treatment of syphilis may be, in the long run, a factor leading to the development later of nervous phenomena, including general paralysis and tabes, and

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therefore, while I appreciate the points that have been made to-night, I still want more information. Perhaps Dr Lees will, at some not distant date, give the Society a paper on this important subject

Dr Ninian Bruce in reply said—When I started the paper I defined the main object as the question of the treatment of ataxia, and my object in doing so was partly because the treatment of ataxia along the lines I have elaborated to-night, is an interesting example of a functional nervous disturbance which is taking place, on the physiological, rather than on the psychological, level. At a time when psychological disorders of function are being discussed at such length, I thought it was important that we should remember there are physiological disorders of function which may also complicate organic nervous disease, and thus it is of considerable help in understanding many processes which are taking place in the central nervous system, if we should have a clear idea of the integration of reflex pathways, of what happens if anything should cause a disintegration of reflex action, and lastly of how the whole thing may be reintegrated; and locomotor ataxia is singularly helpful in explaining and illustrating these disturbances.

The remarks of mine to which Professor Bramwell referred were largely on subjects which are controversial, and any criticism which Professor Bramwell made upon these remarks would rather be a contribution to our knowledge than an attempt on my part to lay down a definite statement to-night. The particular point I mentioned about ataxia was the mechanical disturbance and its readjustment, and that the physiological disorder of function is not directly proportionate to the organic lesion.

Mr Lees mentioned that he had a case of syphilis with a neurotropic strain, which he used as an argument rather against the neurotropic possibility, but that seemed to me to be an argument in favour rather than against it, because general paralysis and nerve deafness are what a neurotropic strain would tend to produce.

In regard to Dr Fleming's remarks about the satisfactory results he had got from the use of Frenkel's exercises, what struck me was that he noticed great benefit when the patient did not watch every footstep. Dr Fleming said that he made the patients always look up. I think Dr Fleming is right and that actual blindfolding is not so necessary, so long as we see that the patient does not watch every movement he makes.

When I spoke of a patient who was blind and on recovering his sight became ataxic, I did not mean a patient with complete optic atrophy. As a matter of fact, I entirely agree with both Dr Traquair

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and Dr Fleming, that optic atrophy, once established, is permanent, but what I actually said was a tabetic who was "blind," and you have to remember the particular influence of what I have described as the mental chaos. If a patient is becoming blind, he often develops a large number of fears and phobias, so that the treatment of tabes is very similar to that of syphilitic neurasthenia. When I spoke of a tabetic recovering his sight, I meant recovering from the functional blindness which may be present and complicate tabes—not actually from the optic atrophy. Part of the blindness may be associated with some particular fear, and when that fear is dispersed, the sight partially recovers.

The object which I had in mind was that we might perhaps manage to acquire a certain amount of insight into these disturbances found in cases of organic nervous disease, if we learned how the integrative action of the nervous system may be altered and how much benefit can be derived by re-establishing the previous physiological pathways. I also wished to draw attention to the fact that many of the symptoms present in organic nervous disease are functional disturbances, not directly related to the organic lesion, and thus often curable if their nature is understood.

Exhibition of Specimens

Dr E. C. Fahmy showed **multilocular ovarian cyst** with malignant change in the pedicle. The specimen was removed from a patient, aged 58, who was twelve years past the menopause. There were no symptoms except the fact that the abdomen was getting larger. At operation there were no adhesions, no free fluid, no blood in the abdomen. When just about to clamp the pedicle, a small, semi-solid area was noticed in the pedicle of the tumour. It was doubtful whether it was malignant or not. The patient's heart condition was not good and it was considered inadvisable to do anything more.

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detected except some enlargement of the uterus with a small projecting tumour the size of a hazel nut on the fundus. In view of the previous history the diagnosis of carcinoma of the body of the uterus was made and panhysterectomy performed, from which the patient has made a good recovery. Examination of the uterus showed it to contain five small fibroid tumours, two of which were subperitoneal and projected on the fundus. On laying open the cavity of the uterus three submucous fibroids were seen distending it. The largest was a sessile submucous one about the size of a golf ball. Below this were apparently other two, but examination proved there was only one tumour which was constricted into two portions by the internal os. The external os at operation was practically closed, and all the fibroids were markedly calcareous. The President thought that the blood-stained discharge was probably due to an associated senile endometritis as the excision of the labia removed one of the factors protecting the senile vagina from infection.

Exhibition of Specimens

Miss Herzfeld said she was particularly interested in Dr Young's first case. She believed that these tumours were very much more common than was generally thought. In the last six years, in the course of routine examination of every gynaecological specimen, she had had 14 cases of adenomyoma or endometrioma, all diagnosed by Dr Dawson at the R.C.P. laboratory. Of these three had been associated with tarry cysts of the ovary; two were situated in the Fallopian tube or its mesentery; two in the lower part of Douglas' pouch; one in the peritoneum at the side of the uterus; three in the uterine wall, and one cervical polypus. One of the two last cases, which were perhaps the most interesting, was situated in the round ligament outside the external abdominal ring, and was associated with a hernia, whilst the other was situated in the pelvic colon and simulated an annular stricture. As most of these cases could not be diagnosed clinically, they were apt to be missed unless examined microscopically.

In reference to the specimen of endometrioma *the President* drew attention to a paper written by Dr J. W. Hunter, a Fellow of the Society, which appeared in the last number of the *Journal of Obstetrics and Gynaecology* and recorded the writer's experiences with experimental implantation of endometrial tissue. At the recent Congress of Obstetrics and Gynaecology in Manchester Dr Wilfred Shaw had also read a paper which showed that lutein tissue could implant itself on the peritoneum and give rise to growths which were analogous to endometriomata. With regard to the question of radiation treatment in malignant cases, he was surprised that no mention had been made of lead, which seemed to him to be a more hopeful line of treatment inasmuch as its effects were general throughout the body. Almost a year ago he had removed two papillomatous cysts from a lady, one of which burst in the course of removal, and which on examination proved to be malignant. She was given a full prophylactic course of lead treatment and is at present perfectly well with absolutely no trace of recurrence. He would have expected a recurrence to be showing itself by now in the presence of fluid in the peritoneal cavity, but there was none. If one were to adopt radiation treatment, where would one radiate? Lead treatment, with its general constitutional influence, seemed to him more indicated.

Dr James Young said one must not lose sight of the value of lead in these cases. A follow-up of the history of cases so treated showed that where there was a comparatively small amount of tissue left behind one might get very striking success. His practice always was to use lead in cases of ovarian cancer after the operation had removed as much of the growth as possible.

SOME PROBLEMS OF THE MENSTRUAL FUNCTION WITH OBSERVATIONS ON THE RELATION OF THE GRAAFIAN FOLLICLE AND CORPUS LUTEUM TO PATHOLOGICAL UTERINE HÆMORRHAGE.*

By BECKWITH WHITEHOUSE, M.S.Lond., F.R.C.S., Professor
of Obstetrics and Diseases of Women, University of Birmingham,
Honorary Gynæcological Surgeon, General Hospital, Birmingham, etc.

THERE are certain events in the lives of most of us which stand out for all time as cherished memories of the past. One of those in my own case is in the making to-night. As I stand here in this ancient and beautiful city, and before the members of a medical society as old and as rich in tradition as any in Great Britain, I pause for a moment to think of the privilege that is mine. To address the Edinburgh Obstetrical Society with its long roll of very distinguished past and present Fellows is an honour of which one may well be proud, and for that honour I sincerely thank you. When I glance through the list of Fellows of this Society in those wonderful volumes of *Transactions* which are published yearly I find the names of many great pioneers of our art in the past, names which are household words in the world of obstetrics and gynæcology. Those traditions are being worthily maintained by the work of the Fellows to-day, and in the years to come many of their names will, I have not the slightest doubt, be as honoured as those of the giants amongst our forebears.

The subject which I am bringing forward for discussion to-night, is one in which I have been much interested ever since I first turned my serious attention to gynæcology, now twenty years ago. There was perhaps just a tinge of selfishness in my action when in response to your President's invitation I suggested that the subject of my address should be "Some Problems of the Menstrual Function." There is nothing, I think, more stimulating to research than to have work thoroughly discussed under the critical eye of friends; to have as it were a few pet theories torn to shreds. A worker in his own den, whether that den be the hospital ward or a pathological laboratory, is apt sooner or later to fall into a groove. Theory is liable to become an obsession, and without the

* Read 11th May 1927.

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therapeutic stimulus of free and open discussion, the result of research may be but an abortion—the unfinished and incomplete effigy of what might have been a real and beautiful entity. It is in this spirit, therefore, that I venture to submit certain of the results of such observations on the menstrual function as have interested me during my work in the Midlands. Here in Edinburgh research of a similar nature has been and still is in progress, and it will I think be to our mutual benefit to compare the results and to have a frank discussion on the theories that evolve from our combined work.

Now the phenomena associated with the menstrual function may be studied in various ways. Briefly these may be stated as follows:—

- (a) By making a comparison with the sexual phenomena noted in other species in the mammalian tree.
- (b) By a study of material obtained at operation, at different periods in the sexual cycle, and especially during the actual menstrual function.
- (c) By the investigation of the actual function, especially of the menstrual discharge, both in health and disease.
- (d) By noting the effect, both immediate and remote, of excision of parts of the sexual apparatus at different periods of the sexual cycle.
- (e) By the observation in animals and “homo” of the effect of injecting various tissue extracts.

These are the lines upon which we are working in Birmingham, and which as time goes on have altered many of my preconceived ideas with regard to menstruation.

The Nature of the Menstrual Function.—The first question that I propose to discuss is “What is the menstrual function in the genus ‘homo’?” The generally accepted view, of course, is that it is a preparation of the uterus for the reception of the fertilised ovum. In other words that it corresponds to the stage of pro-œstrum in the lower mammals. That this is not entirely correct I am firmly convinced from data which I shall shortly place before you. In order to make the position clear, however, it will be necessary to refer briefly to the phenomena associated with the sexual cycle in other mammalian types.

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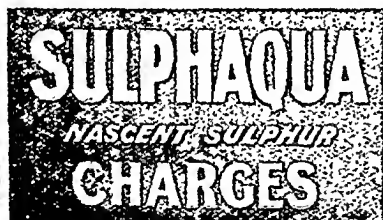


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Problems of the Menstrual Function

Heape the "sexual season." At other times in the majority of wild species, the reproductive organs are quiescent. During the sexual season, which in the wild state occurs usually but once a year, the female experiences a series of cyclical periods of sexual activity. Each of these successive periods during the sexual season constitute an "œstrus cycle," divided by Heape into four sub-sections:—

- (1) Anœstrum, or period of rest.
- (2) Pro-œstrum, or period of endometrial growth and functional activity.
- (3) Cœstrum, or period of desire, when fertilisation is effected.
- (4) Pregnancy, or "Pseudo-pregnancy."

During the anœstrum or rest period the uterus is in a state of quiescence. Its glands are small and the organ is relatively anæmic. The ovaries also, so far as the Graafian follicles are concerned, are also inactive. It is a period of slow growth and development of the follicles, which do not appear on the surface of the ovaries until the succeeding stage of pro-œstrum.

With the advent of "pro-œstrum" or "coming on heat," functional activity of the sexual apparatus is initiated.

The ripe follicles project on the surface of the ovary and coincidently with their full development the endometrium exhibits evidence of increased growth and vascularity. The glands secrete and the congestion of the stroma is so great that rupture of the thin-walled capillaries occurs with extravasation of blood into the surrounding tissue. This extravasation and flushing of the endometrium with blood is so extreme that not only does it occasionally lead to disruption of the glands and the appearance of red cells in their lumina but also in some animals as the bitch to a partial breach of surface of the endometrium and the appearance of external hæmorrhage per vaginam. We must note, however, that although pro-œstrum is always associated with increased vascularity of the endometrium and glandular activity it is only in a few mammalian types that hyperæmia is so extreme as to give rise to external hæmorrhage from the uterus. The more common phenomena is profuse secretion of the glands only, with a slight superficial desquamation of the cornified cells of the vagina. The appearance of these cornified cells in the

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secretion contained in the vagina has recently been made use of by Papanicolaou, Wright and Dodds, and others as evidence of pro-œstrum in their investigations of the sexual cycle in rodents.

Pro-œstrum is followed directly by œstrum, which in the majority of mammals is the period when coition occurs. It is also in many animals, but by no means all, the point in the sex cycle when ovulation occurs from the ripe follicle. Œstrum lasts from a few hours as in the sheep to about a week in the case of the bitch. It is interesting to note in types where no denudation of the endometrium occurs during pro-œstrum, that œstrum is comparatively a short period as compared with other animals as the bitch where regeneration of tissue is necessary. During œstrum activity of the uterine glands continues, and the uterine cavity contains much secretion. Leucocytes take the place of the "cornified cells" in the vagina and their presence is an indication of the onset of this stage.

Now if fertilisation does not occur a state of pseudo-pregnancy supervenes which is of particular interest to us as gynæcologists. This state, in essential anatomical details so far as the ovary, uterus, and mammary glands are concerned, resembles a condition of true pregnancy. The variation is merely one of degree.

In the ovary, the corpus luteum resulting from the ruptured Graafian follicle persists throughout pseudo-pregnancy, and towards the end of the period assumes the yellow colour due to the lutein lipoid. The uterus exhibits *increased* vascularity, and the endometrium, both stroma and glands, undergoes considerable hypertrophy. This hypertrophy in both macroscopic and microscopic detail is to be regarded as an embryonic decidua. The retention of secretion of the uterine glands may in fact be the equivalent of what in pregnant ungulates is known as "uterine milk," a possible source of nutrition to the developing ovum. In this connection I would ask you to remember the high calcium content of the secretion of the corporeal uterine glands. If it is not required by pregnancy it is discarded, and this accounts for the high calcium content in the menstrual lochia of the human female.

At the end of pseudo-pregnancy, the actual duration of which is a very variable quantity in different animals, a stage of involution sets in, characterised by degeneration of the

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endometrium or decidua and in some instances by definite necrosis associated with hæmorrhage. In the bitch, whilst bleeding occurs at this stage also into the tissues of the endometrium there is no external hæmorrhage. In other mammals, *e.g.* the cow, a definite post-œstral hæmorrhage occurs forming the so-called "menstrual clot." This is thought by Hammond to coincide with the termination of a short pseudo-pregnancy and he is probably right. When the pseudo-pregnancy is short it will be readily understood that hæmorrhage is more likely to be a feature of the tissue necrosis that follows its termination, owing to the embryonic state of the pseudo-decidua.

We therefore arrive at the very important observation that in the mammalia hæmorrhage from the genital tract can and does occur in different species at the following points in the sexual cycle:—

(1) During pro-œstrum, as a result of the local hyperæmia of the endometrium incidental to this physiological state—*cf.* the bitch. (2) At the end of pseudo-pregnancy, resulting from degeneration of false decidua and necrosis of this structure—*cf.* the cow.

In other types, *e.g.*, the sheep, cow, mare, and various rodents no external hæmorrhage into the uterine cavity occurs at all, either during the stage of pro-œstral congestion or during involution at the end of pseudo-pregnancy. Now the mammalia naturally fall into two well-defined groups:—

- (a) Species in which the sexual season is associated with but one complete œstrus cycle — the so-called "monœstrus type" of Heape.
- (b) Animals in which there is a recurrence of short œstrus cycles at regular intervals throughout the sexual season—the "polyœstrus type."

Amongst polyœstrus types much variation exists both in duration and kind with regard to the various units of the œstrus cycle. Generally speaking, however, it may be said that the sex cycle of the polyœstrus animal differs from that of the monœstrus in the following particulars:—

- (1) Anœstrum may be absent as in the primates.
- (2) Pro-œstrum is short and in practically all species is characterised only by congestion of the endometrium with increased activity of the uterine glands, but *no external hæmorrhage.*

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- (3) Œstrum is very short and may be only a matter of a few hours.
- (4) Pseudo-pregnancy is also abbreviated and its termination may be associated with hæmorrhage from the uterine cavity.

N.B.—The brief pseudo-pregnancy between the recurring short cycles of polyœstrus animals was wrongly regarded by Heape as being a short rest period and called by him the "di-œstrum." Using the same terminology Heape calls the short sex cycle of the polyœstrus mammal the "di-œstrus cycle."

Although the polyœstrus state occurs naturally in certain wild species, particularly rodents, it is a fact that in domestic types it appears to be the direct outcome of selective breeding, altered feeding, and changed environment. Marshall has drawn attention to the fact that whilst the wild sheep is monœstrus, the Scottish "blackface" in the Highlands has two di-œstrus cycles in the sexual season. The same breed under the improved conditions of the Lowlands increases the cycles to five or six. On the other hand various English breeds, *e.g.*, the "Dorset horn," exhibit still further activity and frequently have two sets of lambs in the year. With the merinos of New South Wales the di-œstrus cycles succeed one another throughout the year and there is a complete absence of anœstrum. The purpose of such extreme cyclical sex activity is of course to increase the possibility of pregnancy and so promote the fecundity of the species. The artificial development of the polyœstrus from the monœstrus type as a result of feeding and environment is an interesting and important aspect of comparative physiology to the gynæcologist. Recently Beaumont and Dodds have shown the importance which certain foods rich in vitamin E, *e.g.*, wheat, peas, lettuce, etc., have upon the reproductive function. It is, I think, rather an interesting coincidence that in the arid tracts of the Sahara the only sustenance available for the herds of goats is a food particularly rich in this vitamin, *viz.*, the Alfa grass.

Ovulation and the Sex-Cycle.—Let us next consider the position that ovulation occupies in the sexual cycle. In the majority of polyœstrus animals, rupture of the Graafian follicle occurs either during or shortly after œstrus. In a few types

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e.g. the rabbit and cat, pro-œstrum and œstrum are apparently fused and ovulation *only* occurs a few hours after coitus. In the absence of coitus there is no dehiscence and no formation of a corpus luteum. Under these conditions pseudo-pregnancy is absent and a prolonged œstrus passes insensibly into a state of anœstrum. The unruptured follicles in the ovary become atretic and degenerate with hæmorrhage into their cavities, a fact of considerable interest owing to a *possible similar production of fibro-cystic ovaries in the human female*.

When coitus occurs with a vasectomised male in the case of the rabbit or cat, a corpus luteum forms as usual, followed by the characteristic decidual development associated with pseudo-pregnancy.

In the primates a degree of complexity is found with regard to the sex cycle and ovulation which appears to have caused some difficulty in the proper interpretation and appreciation of the physiological facts accompanying the clinical phenomena.

In both man and monkeys the sexual life of the female from puberty to the menopause consists of a constantly recurring series of short œstrus cycles. There is no anœstrum and the sex cycles are constructive and continuous. There appears to be no doubt, however, that each cycle as in other polyœstrus types consists of a pro-œstrum, œstrum, and a pseudo-pregnancy.

Although monkeys exhibit an unbroken succession of such cycles it is very interesting to find that in certain types breeding is restricted to certain periods of the year. It is evident, therefore, that *fertile* ovulation must be carefully considered as being a phenomenon apart from pro-œstrum. Corner has made the observation that in some monkeys when ovulation has not taken place and there is consequently no corpus luteum and pseudo-pregnancy, menstrual hyperæmia still occurs.

Ovulation in the monkey according to Corner's observations takes place between the fourteenth and sixteenth days of the menstrual or sex cycle. This corresponds to the recent work on the human species by W. Shaw and others who, by a study of the life-history of the corpus luteum, have proved that ovulation in *Homo* occurs between the thirteenth and seventeenth days of the menstrual cycle. Ovulation in both man and monkeys is generally independent of coition. I say "generally" because

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in some fibro-cystic ovaries examined from single women, I have on occasion failed to find any evidence of recent or remote lutein tissue. May it be suggested that this is an atavistic state of sexual function?

In both man, and monkeys under domesticated and therefore artificial conditions, coitus occurs at any time during the menstrual cycle. There is some evidence that a short œstral period does occur in the human female immediately after the menstrual function, but generally speaking it appears to be independent of the sexual cycle. In fact, as we know, the sexual stimulus persists after complete ablation of the essential sexual organs, at any rate during the period of active sexual life.

As Marshall has pointed out, luxurious conditions favour the prolongation of œstrum and "in some of the lower animals when stimulated by abundant food supply (*e.g.* domesticated rabbits) coition often occurs during early pregnancy, when it can serve no purpose in perpetuating the race."

In the human species the difficulties which arise in arriving at a proper conception of the menstrual function are minimised I think if we remember that *pro-œstrum* and *œstrum* provide one set of phenomena. *Ovulation* and *pseudo-pregnancy* provide another. In the human female the picture is complicated by the simple fact that *both sets of phenomena overlap*.

Ovulation occurs between the thirteenth and seventeenth days of the menstrual cycle. This observation of Schroeder's I have repeatedly confirmed from investigation of the ovaries in relation with the menstrual cycle in a series of laparotomies performed for various indications.

From the date of ovulation a state of pseudo-pregnancy exists until its termination about the twenty-eighth day of the period when necrosis of the menstrual decidua takes place and external hæmorrhage commences. *Pari passu* with the period of completion of the pseudo-pregnancy a state of pro-œstrum develops which reaches its acme also about the twenty-eighth day of the cycle, *but persists during the abortion of the pseudo-pregnancy*. This is followed at the conclusion of the menstrual hæmorrhage by a short œstral period, nature's provision to promote fertilisation of the ovum about to be liberated from one of the succeeding follicles undergoing maturation.

The menstrual discharge in the human female therefore

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normally contains blood derived from the endometrium as a result of two distinct factors:—

- (a) Hæmorrhage resulting from necrosis of the endometrium caused by abortion of the pseudo-pregnant decidua.
- (b) Blood produced by rupture of the capillaries caused by pro-œstral hyperæmia.

Appreciation of this fact, viz., that menstruation in the primates is a composite process involving two separate and distinct functions, each subserving a special physiological purpose, but overlapping the other in order to secure the maximum effect in the shortest time, throws considerable light upon what otherwise is a complex and difficult problem.

I will give you an analogy. The menstrual function may be compared with the stage of a theatre between two acts. One set of scene-shifters are busy removing the paraphernalia of the last scene whilst another are engaged in the same place and at the same time in reconstruction for the next act. Both are working together at top pressure, and occasionally, I am afraid, one gets in the way of the other!

Now it is possible to study both sets of phenomena independently, and in considering the recent work that has been and is being done on the menstrual function, it is important to keep this distinction well to the front. My own observations, like those of Frankel, Halban, Schroeder, W. Shaw and others, are more concerned with the investigation of what may be termed the "pseudo-pregnant" aspect of the menstruation. On the other hand the work of Adler, Allen and D'Oisy, Marshall and Dixon, and Dodds and Wright has been mainly in relation with the isolation and function of the hormone which produces "pro-œstrum."

It is unnecessary to detail at any length the anatomical features of the human endometrium at different stages of the sexual cycle. The appearance of the so-called "constructive," "destructive," and resting stages are sufficiently well-known. Too much stress, however, has I think been laid upon the sharp demarcation of these phases. It is far more important to remember that the endometrium in health from puberty to the completed menopause is never actually at rest. It is always either functioning or preparing to function. As Schroeder

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has pointed out there is evidence of commencing secretory activity of the uterine glands from about the thirteenth to the seventeenth day of the menstrual cycle. This activity increases, but as I have shown elsewhere, there is also an increasing *retention* of secretion as the cycle advances, owing to constriction of the ducts by the developing decidual cells of the stratum compactum. It is not until some necrosis of the stratum compactum occurs on the first day of the menstrual function that there is a sudden out-pouring of the pent-up secretion.

As a matter of fact a few dilated glands with "fern-like" processes are constantly to be seen in sections of the endometrium from the seventeenth day of the cycle onwards. They, of course, become more numerous as the length of the cycle increases owing to the constriction of more ducts. In the fully developed menstrual decidua these dilated glands form a very distinct feature in transverse sections through the uterine cavity and constitute the "stratum spongiosum." With the complete development of the "stratum compactum" it will be understood that liberation of the corporeal secretion is not possible until necrosis of the superficial layers of the endometrium has removed the constriction of the ducts.

This is an important fact in view of the criticism that the formation of a menstrual clot is a normal part of the physiological mechanism of the menstrual function in the human female. Blair Bell contends that the formation of a thrombus is impossible in the presence of a thrombolysin. The answer to this criticism is that the thrombolysin contained in the secretion of the uterine glands is not liberated until the thrombus is already formed.

That a menstrual clot in the uterine cavity *is* formed during the process of molecular necrosis of the menstrual decidua is certain; the original observation has been repeated on several occasions, and it has been confirmed by W. Shaw and others.

It is also equally certain that the menstrual lochia in health contains frequently no clots, although it is by no means uncommon to find in the discharge very small thrombi in process of disintegration.

The discharge normally consists of the products of endometrial necrosis and autolysis with the secretion of the corporeal glands. It therefore contains no fibrin or fibrinogen but it does

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Problems of the Menstrual Function

contain a high percentage of calcium, possibly necessary should pregnancy occur, but otherwise discarded.

The Relation of the Corpus Luteum to the Menstrual Decidua.—During the last quarter of a century a great deal of work has been done in the investigation of the structure and life-history of the corpus luteum and especially the relation of this body to the menstrual function.

To Frankel belongs the credit of first drawing attention to the relationship which exists between the corpus luteum and menstruation. By destroying the corpus luteum with the actual cautery he altered the menstrual rhythm, and in the case of pregnant animals he produced abortion. As a result of these experiments Frankel came to the conclusion that the function of the corpus luteum was to maintain the nutrition of the uterus from puberty onwards and to prepare the endometrium for the embedding of the ovum. He also thought that the lutein hormone was responsible for the local hyperæmia which accompanies menstruation.

Frankel's work was criticised chiefly on the basis that the cautery did not destroy all the lutein tissue in the ovary.

Halban therefore carried the investigations a step further by actually excising the corpus luteum in 40 cases. He found that uterine hæmorrhage occurred in 92.5 per cent. of the cases so treated. Strangely enough, however, this observer made no attempt to correlate the hæmorrhage with menstruation, and in fact came to the conclusion that the menstrual function was not due to the corpus luteum but to ovulation!

Halban thought that the lutein hormone exerted an inhibitory effect both upon menstruation and ovulation.

Meyer and Ruge, Miller and Schroeder, however, by studying the development of corpora lutea in relation with the anatomical appearances of the endometrium brought forward evidence in support of Frankel's original thesis.

Schroeder in fact pointed out that whilst a young corpus luteum is always present at the commencement of endometrial activity, a mature corpus luteum is associated with what is generally recognised as the pre-menstrual state of the endometrium. Furthermore degeneration of the corpus luteum is found during the period of active endometrial necrosis.

This was the position when, in 1926, I decided to repeat Halban's experiments and at the same time to make a careful study of the endometrium should uterine hæmorrhage occur.

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The result of my first observation described in detail in the *The Journal of Obstetrics and Gynæcology*, vol. xxxiii., No. 3, was to convince me that the effect of excision of the corpus luteum was to produce necrosis of the uterine endometrium.

Material was obtained which proved quite conclusively that the uterine hæmorrhage artificially produced on the eighteenth day of the menstrual cycle by excision of the corpus luteum thirty-nine hours previously, was in essential details identical with that of the "menstrual period." I had, in fact, ante-dated the normal function by ten days. More interesting still, the next "period" did not occur until forty-four days later or only four days later than it would have occurred had no interference with the rhythm taken place.

Since this paper was published further observations have been made, and to-night I am able to carry the deductions a step further.

Twelve more opportunities have occurred of excising the corpus luteum at periods varying between the seventeenth and twenty-fifth days of the menstrual cycle, and in every instance uterine hæmorrhage with endometrial necrosis has followed within thirty-six to forty-eight hours of the operation. In each case also the next following menstrual period occurred within a few days of the normal period, had no experimental interference taken place. In other words the *only alteration of the rhythm was to ante-date the menstrual period directly in proportion to the date on which removal of the corpus luteum was effected.*

Examination of the corpora lutea which were removed showed that this structure is *normally a cystic body* and that although there is much proliferation of the cells of the tunica granulosa with resultant thickening of the wall, a cavity is always present containing a clear fluid. The point of rupture of the parent follicle is usually evident on the surface of the corpus luteum as a small dimple or scar. The aperture is apparently closed by approximation of the growing cells of the tunica granulosa, now accepted as being identical in type with the large lutein cells of the fully developed corpus.

The corpus luteum increases in size but maintains the same grey cystic appearance until immediately before the onset of the menstrual abortion. Lipoid degeneration then occurs characterised by the appearance of the yellow pigment in the cells and hæmorrhage in the cavity. Hæmorrhage is the

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result of degeneration and fatty necrosis and not a sequel of dehiscence of the follicle. For this observation we are indebted to Wilfred Shaw, and with his views on this point I entirely agree.

The cause of lutein degeneration in association with menstruation is still a problem. My own view is that it is closely related with death of the unfertilised ovum. I have recently suggested that it is the result of a "negative" phase initiated by the vaccine action of the unfertilised dead ovum and the cells of the corona radiata, cells morphologically identical with the large cells of the corpus luteum.

The Relation of the Graafian Follicle to the Menstrual Function.—It is evident from the results of excision of the functionally active corpus luteum that this body exerts an important influence upon the development of the endometrium. In fact it appears that the growth of the menstrual decidua is entirely dependent upon its proper function, and that withdrawal of its active principle is followed within forty-eight hours by necrosis of the endometrium.

It appeared a matter of interest, therefore, to study the effect of similar investigations in relation with the Graafian follicle before its rupture on the thirteenth day of the cycle.

On three occasions, therefore, the opportunity was taken to destroy developing follicles before maturity by "needling" both ovaries. It was found on each occasion that uterine hæmorrhage commenced within forty-eight to seventy-two hours of the operation. All the investigations were made before the thirteenth day of the menstrual cycle and in the absence of any functioning corpus luteum.

These observations were interesting, but were regarded as inconclusive since it was thought possible that the uterine hæmorrhage might be the result of pro-œstral congestion resulting from the peritoneal absorption of a follicular hormone.

A further series of four observations therefore were made of excising large Graafian follicles either by double or single partial oöphorectomy. In three out of the four cases, uterine hæmorrhage began within seventy-two hours of the operation. In these three cases the excision took place between the tenth and thirteenth days of the cycle. In the patient where no hæmorrhage occurred, the operation was performed on the seventh day of the cycle or three days after the termination of a four-day period.

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It was concluded therefore from this second series of observations that the uterine hæmorrhage occurring in the first group *was* due to the destruction of the follicle and not to the absorption of follicular hormone.

In the case of the three patients whose ovaries had been "needled" the opportunity was taken of collecting some of the liquor folliculi, and amounts varying between $\frac{1}{2}$ to 1 c.c. were injected intravenously into other patients without producing any obvious clinical effect.

The uterine hæmorrhage produced by excision of Graafian follicles differed somewhat in type from that produced by removal of the corpus luteum. It was comparatively slight, somewhat irregular, and continued seven to ten days—in fact, longer than the usual menstrual bleeding and comparable with the pathological type which I have called "Menostaxis" as distinct from "Menorrhagia."

These observations point to the fact that *not only the corpus luteum but also the Graafian follicle is responsible for the growth of the endometrium*, which certainly appears logical owing to the development of the former from the cells of the latter.

The follicular hormone therefore appears to be a complex body possessing more than one active principle. That it contains a body capable of producing œstrus in the lower animals has been proved conclusively by the work of Adler, Fellner, Herrmann and Frankel, Allen and D'Oisy, Stockhard and Papanicolaou. Recently Dickens, Dodds, and Wright have isolated from sows' ovaries a physiological principle in the form of an oil which stimulates œstrus in rats, and which has a marked depressor action.

It is only reasonable to suppose that a similar œstrus-producing principle is present in the ovaries of women although actual physiological proof is as yet required. There is certainly no evidence available to prove that the intravenous injection of liquor folliculi has any influence in the production of the menstrual hæmorrhage in the human female. In fact my observations all tend to show that the uterine bleeding is produced as the result of endometrial necrosis by the *withdrawal* from the circulation of some principle elaborated by the follicle and the corpus luteum which is essential for its development.

The œstrus-producing hormone of Dickens, Dodds, and Wright obtained from pigs' ovaries was not, however, confined

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to the liquor folliculi. It was present in extracts from the whole ovaries, and these workers state definitely that their findings do not support the contention of Allen and D'Oisy that the active principle is mainly a feature of the liquor folliculi. Allen and D'Oisy themselves did not find it in extracts of the corpus luteum. On the other hand Samson Wright has informed me that he and his co-workers have isolated the hormone not only from the ovaries but also from the placenta and various other tissues submitted to them from the gynaecological operating theatre.

In 1914 I called attention to the presence of an œstrus-producing hormone in the uterine secretion of rodents, and it seems probable that the existence of this active principle is only dependent upon the ovaries in a secondary sense. It may indeed be produced in tissues other than the ovaries, *e.g.* the thyroid, as is evidenced in the human species by the persistence of the sexual instinct after complete ablation of the uterus and ovaries, or the occasional occurrence of endometrial congestion and hæmorrhage at a considerable period after double oöphorectomy.

The result of clinical investigation on human ovaries has brought to light therefore the following facts:—

- (1) That removal of the physiological active corpus luteum at any stage of its development during the menstrual cycle is followed directly by molecular necrosis of the endometrium.
- (2) That destruction of mature Graafian follicles before rupture is also followed by endometrial necrosis.
- (3) That excision of mature Graafian follicles likewise results in necrosis of the endometrium.
- (4) That injection of liquor folliculi does not produce uterine hæmorrhage.

It is evident, therefore, that both the Graafian follicle and the corpus luteum contain an active principle which is essential for the proper development and function of the endometrium. If it is withdrawn from the circulation necrosis of the superficial layers of the endometrium ensues. On the other hand its constant stimulus promotes development of the endometrium until the mature decidua is formed.

This active principle is probably produced from the cells of the tunica granulosa, and inasmuch as it is a feature of

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the secretion of both the follicle and corpus luteum neither the name "folliculin" nor "lutein" appears entirely suitable. As an alternative I suggest the term *ovarin* to designate the hormone which is essential for the proper growth and function of the endometrial stroma.

The recently introduced term "Œstrin" should, I think, be reserved for the other œstrus-producing hormone of the follicle which experiment shows is not present in the corpus luteum.

"Œstrin" is probably responsible for the pre-menstrual congestion and functional activity of the uterine glands. "Ovarin," on the other hand, controls the growth of the stroma, and the withdrawal of this hormone from the circulation initiates endometrial necrosis with hæmorrhage from the congested stroma.

The significance of this conception of the menstrual function has, I think, an important corollary in the explanation of some cases of pathological uterine hæmorrhage. If endometrial necrosis ensues upon the destruction or excision of the maturing follicle and the corpus luteum it is reasonable to suppose that similar trauma effected by disease is followed by like results. This is indeed the case, and many instances of irregular uterine hæmorrhage in association with fibro-cystic ovaries, prolapsed ovaries, and chronic inflammatory disease of the uterine adnexa are, I think, due to the death of maturing Graafian follicles and pathological corpora lutea. Recently I have investigated several ovaries from cases of large fibroids where metrostaxis as well as menorrhagia has been a feature, and in every instance I have found large cystic unruptured follicles, as well as corpora lutea in various stages of degeneration. The follicular or lutein cysts in many instances contained blood. It seems to me probable, therefore, that in these cases *both the uterine hæmorrhage and the sterility have a common ovarian origin.* The sterility is due to unruptured follicles and the metrostaxis to the periodical irregular cutting off of the supply of "ovarin." It is in these and similar cases infinitely better for a Graafian follicle never to develop at all. Partial maturity with subsequent death is probably always associated with endometrial necrosis and hæmorrhage, such as is commonly found during the years of the menopause and at puberty.

Excess of the "ovarin" hormone is, I think, one of the

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causes of precocious decidual development, and, as I have shown elsewhere, it appears to be a factor in the production of severe menstrual pain.

In conclusion, may I say just a word with regard to the therapeutic value of so-called ovarian and lutein extracts. I am afraid that I cannot claim hitherto to have had any considerable and *sustained* success with any single extract at present on the market. This is more particularly the case in the control of irregular functional uterine hæmorrhage—metrostaxis, in other words. Every now and again one has an apparent success, and then in another case with precisely a similar pathological picture and using the same commercial preparation, no result whatsoever is obtained. Now I think that the cause of these discrepancies lies in the fact that in the first place whole animal ovaries are used in the preparation of the extract. In the second place I doubt very much whether many commercial extracts are made when “ovarin” is present in the organs used. For a preparation to have any physiological action in the prevention of premature endometrial necrosis, and therefore hæmorrhage, it should be made either from *mature* Graafian follicles or from *functionating* corpora lutea—not the degenerated “yellow bodies” which are but the empty shell, and from which the inmate has escaped.

Not until extracts are always made from animals' ovaries *during either pro-œstrum or the early months of pregnancy*, do I expect on physiological grounds to obtain uniformly satisfactory therapeutic results.

DISCUSSION.

Dr Haig Ferguson expressed the pleasure he had had in listening to the paper which they had just heard from such a well-known authority as Professor Beckwith Whitehouse. What he said on the subject of menstruation must always command attention, and certainly his observations on the fact that blood does clot in the uterus during menstruation seemed very conclusive. The mechanism he described by which the pent-up secretion is liberated from the uterine glands seemed a rational one. Professor Whitehouse's remarks on the varying activity of the ovarian extracts sold in the market, certainly fitted in with most people's experience, and the explanation which he had given seemed to be a sound one.

Dr Fordyce asked why follicular cystic ovaries should give rise to menorrhagia? Why, when one removed a large cystic ovary with some

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clear fluid in it, was the menorrhagia cured? This seemed to be at variance with Professor Whitehouse's experiments and deductions.

Dr James Young said that gynecologists were following with considerable interest and not a little admiration the way in which the Birmingham school was tackling these very difficult problems. The general conclusions at which they were arriving seemed to be in accordance with the data which they had been able to gather. Whether it was possible or not to concur in all the conclusions was a matter of secondary moment.

Professor Beckwith Whitehouse believed that in the human cycle there is a certain amount of overlapping of the pre-œstrum and false pregnancy. This point introduced some very interesting possibilities and a few complexities. So great were the complexities that he wondered how far the conclusions were in accordance with the facts. It had been suggested that this overlapping had as its natural effect the fact that œstrus occurred soon after menstruation. On the other hand, he considered it more likely that œstrus coincided with the time when ovulation occurs in the human female, that is, about the thirteenth or seventeenth day. Otherwise there would seem to be too large a gap between coitus and the escape of the ovum from the follicle.

Another interesting point advanced by Professor Whitehouse was that the lipoidal change in the corpus luteum seemed to coincide with the late or disintegration stage.

Dr Young wondered why, if the female sex hormone was so widely scattered throughout the body, occurring in the thyroid and other tissues, the cycle should be upset at all by an experiment. Why, indeed, should there be any cycle at all? It was commonly believed that the cycle was dependent upon the periodic liberation of the hormone in the ovary and that this was specifically related to the rotation of change occurring in this organ.

Dr Young was specially interested in the recent evidence pointing to the fact that in some cases disease in the ovary might cause uterine bleeding because as far back as 1912 or 1913 he had read a paper to the Society with a description of some cases which seemed to support such a conception. He concluded at that time that there was some definite relationship between the diseased process going on in the ovary and the uterine bleeding.

Another point which emerged from recent work and to which Prof. Beckwith Whitehouse had referred in his paper was that this hormonal substance seemed to be obtainable from the placenta as well as from the ovary. As far back as 1909 he (*Dr Young*) had suggested that the secretion of the ovary and the extra-chorionic secretion of the placenta were identical in so far as their major effects on the uterine mucous membrane was concerned. This view which Dr Young urged

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many years ago and which was based on a prolonged study of the problem was now thoroughly established by the work of subsequent investigators. In fact the placenta was sometimes employed as the organ from which the oestral hormone was commercially extracted.

In dealing with the problem of the cause of degeneration of the corpus luteum, was it not conceivable that this organ had a definite period of life, and would die unless it got some impetus from a growing ovum? If fertilisation took place, it would take place presumably from the 14th to 16th day, and by about the 21st to 23rd day the ovum should be embedded in the uterus. By the 28th day it should be reaching a fairly good size. Was it not possible that the absence of an embedded and growing ovum of that size at the time the corpus luteum of menstruation had reached full development was the cause of the degeneration? This explanation seemed to Dr Young more plausible than the view which Prof. Beckwith Whitehouse had advanced.

Professor Hendry referred to the association of oestrus or the post-menstrual phase with increased sexual desire in women. Undoubtedly conception frequently occurred immediately after a menstrual period, but at that time Professor Whitehouse believed the endometrium to be in a state of necrosis. Did implantation of the fertilised ovum occur in this necrotic tissue, or could we assume that the spermatozoon united with the ovum shed at the next ovulation? Physiologists are accustomed to ascribe very definite functional activities to lipid tissue, but Professor Whitehouse confutes this principle by stating that the lipid development in the corpus luteum is an indication of degenerative change.

The President conveyed the thanks of the Society to Professor Beckwith Whitehouse. He said that it was now becoming more obvious that they must regard the sex cycle as being a much longer one than the mere monthly cycle of menstruation. The complete sex cycle occurred when ovulation was followed by conception and pregnancy went on to full term. In the case of such a cycle the occurrence of the menstrual flow might legitimately be regarded as an infertile abortion. He thought that the study of the function of menstruation and of the corpus luteum was enabling them to form a more unified and a more rational and helpful view of this question. One point he did not understand was the emphasis placed upon the death of the ovum as a possible or probable factor in bringing about the disintegration of the menstrual decidua. He found it difficult to believe that the death of a single cell, even such a highly potential cell as the ovum, could of itself produce such remarkable changes.

His experiences of the therapeutic action of ovarian extract had been variable. He had been inclined to attribute part of such success as he had obtained to the influence of suggestion.

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In reference to the apparent discrepancy between the usually accepted view that conception is most likely to follow coitus occurring shortly after the end of a menstrual period and the modern belief that ovulation occurs on or about the fourteenth day after the commencement of the menstrual period, it seemed to him that the explanation was that it was the ovum set free ten days after the end of the menstrual period which was fertilised, not the one set free by the ovulation which preceded the menstrual period. This view was quite compatible with the facts and would explain how most of the young human ova described in the literature showed evidence of having been embedded during the pre-menstrual stage.

He was sorry that Professor Beckwith Whitehouse had not found time to say something about his views in regard to dysmenorrhœa and the relationship which the disintegration of the endometrium bore to the pain. He hoped that they would have an opportunity some other time of hearing another address from Professor Whitehouse on his original and brilliant work on this subject.

Professor Whitehouse replied.

Meeting—5th June 1927.

James Leslie Orr, M.B., Ch.B., Bearsden, was elected a Fellow of the Society.

EXHIBITION OF SPECIMENS.

Professor Hendry showed (1) **Large congenital hygroma—a potential cause of dystocia.**—The mother of this child had a contracted pelvis of the rachitic type, the true conjugate being estimated at $2\frac{3}{4}$ in. Her first pregnancy ended in a classical Cæsarean section on 29th September 1925. She had a normal convalescence from that operation and went home with her baby, both in good condition, on the twenty-fifth day.

She was re-admitted to the Antenatal Wards of the Maternity Hospital on 2nd November 1926, being then nearly at the end of her second pregnancy. The uterus was noted to be particularly large and the fœtus was found to be lying as a breech. A Cæsarean section was regarded as inevitable in this case. No attempt was made to alter the lie of the child. Labour commenced on 10th November 1926 and at 11 P.M. I performed a repeat Cæsarean section of the classical type. Though the uterine incision appeared ample I was surprised to find that when I dragged the breech out and freed the shoulders I had difficulty in getting the head delivered. I discovered that the obstruction was due to a large tumour in the region of the child's neck.

The photographs and the specimen show the nature of this tumour. Immediately after birth it appeared to increase rapidly in size, and at the end of twenty minutes measured from side to side 7 in.; from the lower lip to its lower border $5\frac{1}{2}$ in., and from the vertex to the lower border $8\frac{1}{2}$ in. The chin dimple was so deep that it looked almost like a sinus. The tumour became a little bluish in colour, appeared absolutely cystic, and gave no crepitations. The tumour increased in size, its breadth measuring later $8\frac{1}{2}$ in. The child was unable to swallow, but it lived until the third day after birth.

It is perhaps fortunate that other circumstances in this case had determined the method of birth, because great difficulty would have been experienced in removing the child through even a normal pelvis.

(2) **Malignant ovarian teratoma, from patient aged 17.**—E. L., aged 17. Puberty occurred at 12. The first menstrual period was preceded by six months' ill-health, during which the patient had frequent attacks of hypogastric and right iliac pain, with sickness. The first menstrual period lasted a fortnight, but since then the periods have been quite regular, lasting four to seven days at 28-day intervals. The periods have always been accompanied by severe pain, requiring rest in bed for two or more days. She has occasionally sickness at

Exhibition of Specimens

this time. The pain is worst before the actual onset of the period. The patient states that there is always abdominal swelling before the menstrual flow, which disappears with the flow.

In April 1925 she had a sudden attack of right-sided pain and was sent into the surgical wards of a general hospital as a case of appendicitis. She was only kept in for one day, the diagnosis of appendicitis not having been confirmed. She continued to have right-sided pain after that, with occasional exacerbations. About December 1925 she first noticed an abdominal swelling, which has been gradually increasing ever since. From the same date the menstrual pain has been increasing in severity. On 8th May 1926 she had a particularly severe attack of right-sided pain, accompanied by sickness. The symptoms got progressively worse until she was admitted to the Royal Infirmary on 12th May 1926.

On admission the temperature was 101.8 F.; pulse 116; respirations 40. There were no abnormal chest signs. Her last period had commenced on 28th April 1926. Examination showed a large median, abdominal swelling extending above the umbilicus, fairly regular in outline and firm to touch but not particularly tender. There was localised tenderness in the right iliac fossa. Percussion note was dull over the umbilical area but more resonant laterally. There was evidence of some free fluid in the abdomen. Vaginal examination showed a solid mass occupying the pouch of Douglas, which was apparently quite distinct from the abdominal tumour because a fairly clear percussion note was got over the symphysis pubis. While the condition resembled closely an ovarian cyst with a twisted pedicle, the free fluid in the abdomen and the distinction between the abdominal and pelvic tumour made even that diagnosis doubtful.

The abdomen was opened two hours after admission. A considerable quantity of serous fluid escaped. The parietal peritoneum was indurated. The omentum at its lower border was infiltrated and its surface covered with small white areas. A large rounded, but slightly irregular swelling, solid in character and very vascular, measuring about 8 in. by 6 in. by 6 in., was found attached by a pedicle to the right side of the uterus. This was an ovarian tumour originating from the right ovary. The tube appeared a little thickened but not distended. The pedicle of this tumour was very vascular. The tumour was removed. The left ovary was represented by a vascular tumour about 3 in. by 2 in., very fixed to the left side of the pelvis. Another rounded tumour, about $4\frac{1}{2}$ in. in diameter, dull red or purple in colour, with large vessels running over its surface, was noted in the pouch of Douglas. Both those tumours were so fixed that their removal would have caused very severe hæmorrhage, so they were left. The abdomen was then closed.

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INDICATIONS

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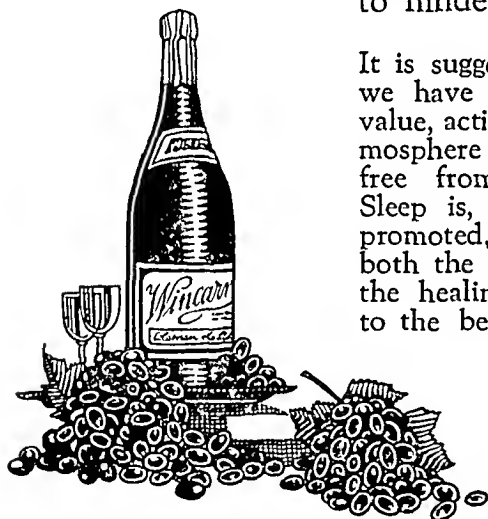
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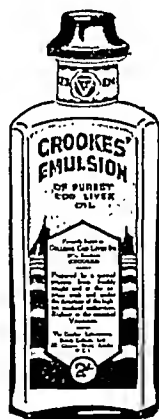
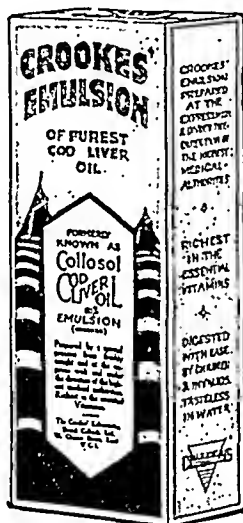
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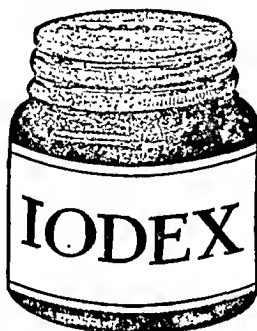
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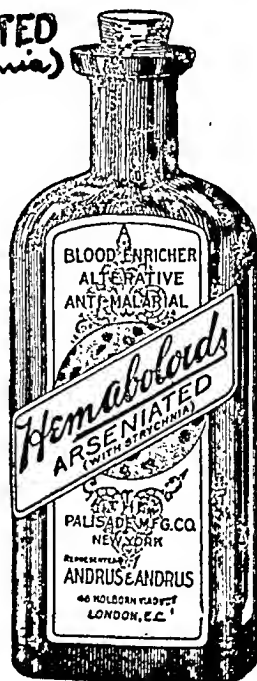
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Edinburgh Medical Journal

October 1927

THE FAMILY DOCTOR AS SPECIALIST.*

By CHARLES E. DOUGLAS, LL.D., F.R.C.S. Ed., Cupar.

I APPRECIATE very highly the honour you have done me in asking me to be the first to deliver this Memorial Lecture. This honour is one which I never thought would come to me. But it so happens that I am probably one of very few who knew well both the foundress of this Memorial and the subject of it, and I should wish as a preliminary to pay a tribute of respect to the memory of both.

Miss Ann Black was an interesting personality. The daughter of a lawyer the Procurator-Fiscal of Fife, one of a family all of whom, except Dr Alexander Black, became lawyers, she came of intellectual stock, and all her life was devoted to Literature and Art, and to travel in pursuit of these. She was, unfortunately, placed at a profound disadvantage by reason of steadily increasing deafness. Had it not been for this I believe that she might have taken some place in the literary world, and she used to write largely under a *nom-de-plume* for the lighter magazines. This pursuit, and an abiding affection for her younger brothers, were the chief pleasures in a somewhat sad and restricted life.

Dr Alexander Black was a graduate of this University, a Fellow of your College, and a cultured physician of no mean attainments. He, like his sister, laboured in his later days under the disability of deafness and, therefore, never attained to a very large practice. He was somewhat of a recluse and was thrown more and more into the society of his books, and converse with a few intimate friends, of whom Sir James Affleck and Professor Caird were perhaps the most intimate. In thinking how I could best discharge the duty you have

* The Alexander Black Memorial Lecture, delivered before the Royal College of Physicians of Edinburgh, 15th June 1927.

Charles E. Douglas

kindly imposed upon me it seemed to me that, in view of his devotion to his work, his carrying on of general practice while combining this with constant study of all that was best in Literature and Art, and his steady and profound dislike of anything that was noisy or meretricious or that savoured of the Quack in Medicine, I could not do better than try to draw for you a picture of the family doctor as he was, as he is at the moment, and as he might become in future; and what beside his daily work he may be to the community.

I am tempted to call this lecture "The Family Doctor as Specialist" because, in effect, I desire to indicate some lines of activity, in his own sphere, and not trenching upon the specialised work outside it in which the family doctor may yet be of great service to the community.

I here take leave to enter my *caveat* against the use of the term "general practitioner" which has come into such constant use. It is a disagreeable word, harsh, unnecessary, and bastard in origin. Harsh, the very sound of it grates on a musical ear; useless, for there are three or four synonyms of decent parentage; bastard, because it is of none. A petitioner presents a petition; the practitioner conducts a "practition," a word unknown, and, one may hope, never to be coined. It is useless to say in its defence that great writers use it; so they do. You meet it in Sir Thomas Watson, one of the purists in English medical literature, in Carlyle, in Sir Walter, in many others. But only on occasion. It is in recent years that it has become the usual phrase and that the family doctor, and particularly the "panel doctor," is almost invariably spoken of as the "general practitioner." We take it meekly. Recent happenings have shown up our extreme docility. Attach the epithet "practitioner" to one belonging to either of the sister professions, legal or clerical, and see how he would take it. I once heard it said: "You doctors are just practitioners upon the public purse!" The sentiment is shocking: the diction is correct. In my view it should be reserved for those gentry, not very numerous, who engage the attention of the General Medical Council. They are "practitioners" in the proper sense of the word. I propose to do myself the pleasure of seeing throughout this Lecture how easily we can do without it.

There are three lines of thought which I wish to pursue with regard to the family doctor and his special position and function in the world of Medicine. It is for him, first to keep

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alive the great truth of the inherent unity of Medicine in all its forms. Secondly, I think we may find that in his work there are positions which he occupies which by their very nature cannot be occupied by anyone else, and in which much useful work might be done; and, thirdly, if I have time, we might consider the ethos of the family physician, what in him is the result of the impact on his mind of the vast body of "Disharmony" with which, from first to last, he has to contend.

I.

The Family Doctor as we see him in History.—To those with the historic sense, when one thinks of the history of Medicine there arises a long vista back into the past. The first glimpse which we have is one with a curious foretaste of extreme modernity. For we find a time when in Babylon

"having no use for physicians they carry the sick into the market place; then those who have been affected themselves by the same ill as the sick man's or seen others in like case, come near and advise him about his disease. None may pass by the sick man without speaking and asking what is his sickness."¹

A custom like this "having no use for physicians" is rather suggestive of the New Health Society and of those writers in the *Spectator* who kindly show us how to be "every man his own physician." The Egyptian temple comes next with its combination of Priestcraft and Medicine. This is the proper beginning for us, for it marks the time when Medicine began as an attempt to assuage the wrath of the angry gods who had flung the arrows of disease in vengeance against the breaking of their laws. What a scene must have presented itself there! Take the witches from *Macbeth*; put them in a bone-setter's clinic and let there enter the High Priest Sarastro from the *Magic Flute* and we should have something like the reality. Of all these factors the intellectual one of Priestcraft, the element inducing fear and wonder personified in Mozart's opera by Sarastro, Vice Gerent of Isis and Osiris, is the ruling element, for it appeals to instincts which are by no means dead among us, which, moreover, like all superstitions contain an element of truth. So far back as Egyptian times then we get the oldest factor in our ethos, that of fear of the gods, and of the physician as one able, if he will, to be a defence against that wrath. We come now to Greece, the

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Motherland of Medicine. One of the most intellectual of living Scotsmen is reported to have done homage to Germany as his "spiritual home." It was untrue. Germany is no one's spiritual home. The white races of mankind have but two spiritual homes, Hellas and Israel. It may be, as Matthew Arnold used to say, that every man is either a Hebraist or a Hellenist; though when we consider the influence that Greek ideas had upon the nascent Christian Church, we do not see the implied antinomy. If Christendom owes its religion to Israel it must acknowledge its debt in every other department of human thought to Hellas. These two reign everywhere; their ideas still rule the world.

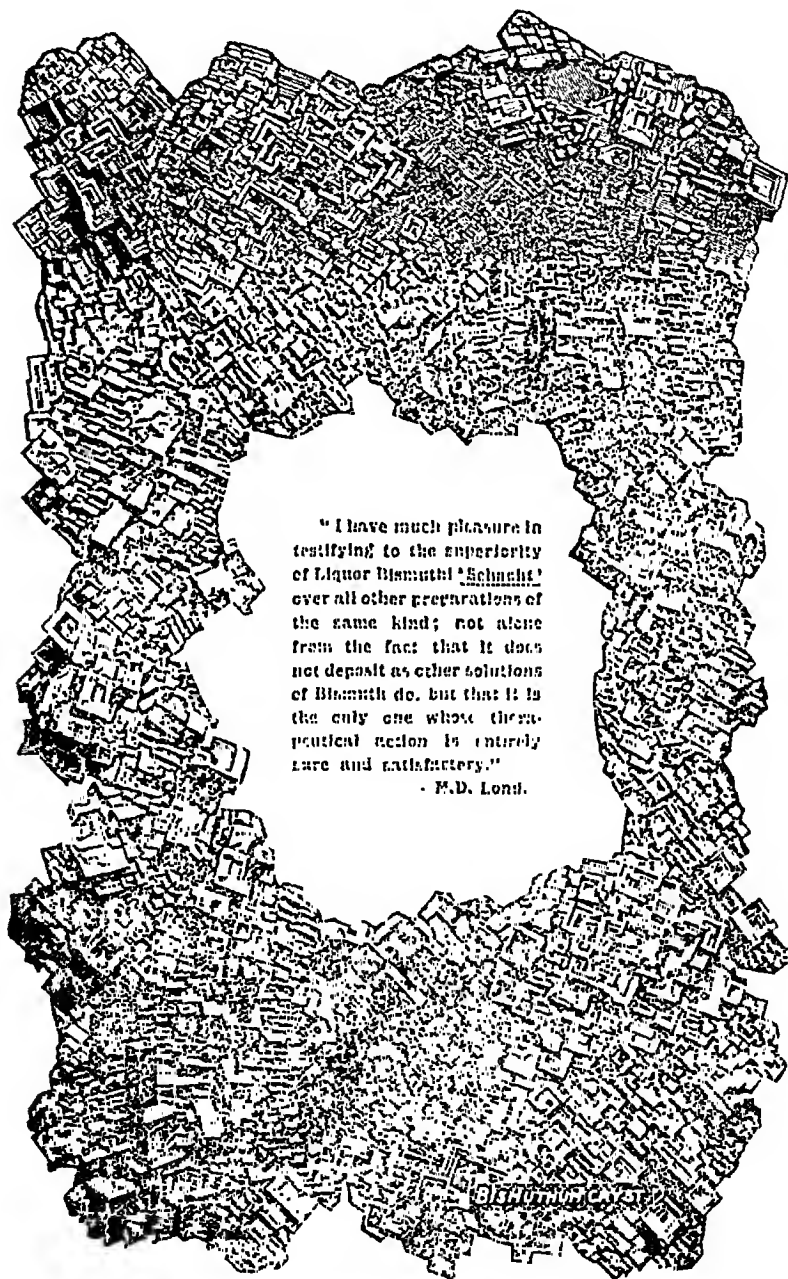
"The Cæsars and the Alexanders pass.
But he that drank the hemlock;
He that drained the cup more dread
On Calvary Hill, remain
Servants, and mighty Conquerors of the world."

But for us in Medicine Greece is truly our spiritual home; it is from her that we drew our earliest nourishment in common with Art, with Music, with Literature, and Philosophy. We think of Hippocrates, the Father of Medicine. But just as

"great men there were ere Agamemnon came,"

so there were great physicians before Hippocrates, and one of these gives me so fine an example of another factor in the ethos of Medicine that I must recall him to your recollection.

The story begins at least twenty-five years before Hippocrates was born. Darius the Great returning from the hunt twists his foot in dismounting from his horse. His Egyptian physicians attempted without success to reduce the dislocation. For seven days and nights, says Herodotus, the King could get no sleep for pain. On information given by one who knew him there is produced Democedes of Croton, a slave, dragging his chains, and clad in rags. He being really a fine physician, "for at this time the best physicians were those of Croton," was able apparently to reduce the dislocation and heal the King. I like the story of his release from slavery. The King, thinking to reward him, ordered him to be decorated with "two pairs of golden fetters." "Is it then your purpose," he asked, "to double my pains for my making you whole?" This neat epigram obtained for him his freedom.² But what intrigues me is the interesting fact that he used his newly found

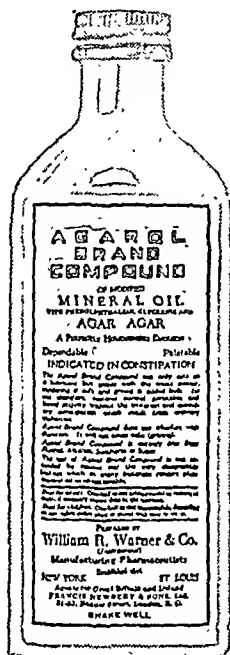


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influence with Darius to save the lives of those Egyptian physicians who had been treating the case unsuccessfully. In those days impalement was the dreadful punishment, the recognised penalty for malpraxis. The physician was regarded as one who could, if he would, obtain release from the wrath of an angry god, and if he failed he had to pay the penalty. Thus death stared those Egyptian colleagues in the face; but Democedes rose to the occasion, and, exhibiting a generosity which was probably unique in those barbarous days, he pled with Darius and pled successfully. Here we see another strand in the golden thread of the medical ethos, loyalty to one's colleagues. Time does not permit further notice of this remarkable man; of his healing of Atossa, Darius' Queen; of his yearning home sickness and the clever wiles he employed to obtain his freedom. Are they not all written in the chatty pages of old Herodotus? The Father of History may be somewhat gurrulous at times, but this story of his about the Crotiat physician rings true, and particularly do we wish to remember Democedes for his loyalty to his colleagues far back there, 2400 years ago. We look upon Hippocrates as our teacher in the higher ethics of the profession. But Democedes is quite possibly not an isolated phenomenon, and we may perhaps infer that the Oath of Hippocrates, if the skill and professional uprightness of Democedes be taken as typical, may indicate not so much the special qualities of Hippocrates himself as the general level of the medical ethos in Grecian times.

Then we think of Hippocrates himself, Father of Medicine, and of the School of which he was the head and example. Which of us does not thrill as we recite the stately periods of the Hippocratic Oath?

"I swear by Apollo Physician, by Asclepius, by Health, by Panacea, making them my witnesses, that I will carry out, according to my ability and judgment, this oath and this indenture. . . . I will use treatment to help the sick according to my ability and judgment, but never with a view to injury and wrong-doing. Neither will I administer a poison to anybody when asked to do so, nor will I suggest such a course. But I will keep pure and holy both my life and my art. . . . Into whatsoever house I enter, I will enter to help the sick, and I will abstain from all intentional wrong-doing and harm especially from abusing the bodies of man or woman, bond or free. And whatsoever I shall see or hear in the course of my profession,

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as well as outside my profession in my intercourse with man, if it be what should not be published abroad, I will never divulge, holding such things to be holy secrets. Now if I carry out this oath and break it not, may I gain for ever reputation among all men for my life and for my Art; but if I transgress it and forswear myself may the opposite be my lot."³

It is not only in the famous oath but in all the Hippocratic writings, even in those which are not certainly authentic, that the same spirit is shown.

"I urge you not to be too unkind, but to consider carefully your patient's means."

"Sometimes give your services for nothing, calling to mind a previous benefaction . . . and if there be an opportunity of serving one who is a stranger in financial straits, give full assistance to all such." "For where there is love of man, there is also love of the Art."⁴

When we think of the debt we owe to Hellas we may feel constrained to carry on those high traditions, we may feel bound to them by invisible strains of a common instinct.

So we may say that in the ethics of Medicine there are around us the Sarastro chain of our high mission to humanity, the Democedes chain of loyalty to our co-workers, and the Hippocratic chain of devotion to our suffering clients and to "the Art"?

In Hellas, then, we see our glorious origin. The so-called Dark Ages intervene for a time, and again at the Renaissance the New Learning is brought to us by the translation of Hippocrates and of Galen, and this time quaintly enough a fat and jolly priest, the Master, Rabelais appears, writes of Pantagruel and Panurge "to please his patients," laughs his Rabelaisian laugh, and disappears from Medicine back to Holy Church. And from then we have progress, but ever with the beautiful shadow of Apollo hovering over us. Harvey himself is full of his debt to Aristotle and the Ancients, but stress need hardly be put upon this, it is so well known to you.

Now let us here note and strongly emphasise, that all these makers of Medicine, from Democedes to Harvey, and even nearer our own times, were in the general practice of Medicine. Harvey was a physician; but he cut for the stone, removed a breast from Lady Howard the High Admiral's wife, and bequeathed his surgical instruments to his friend and successor

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Sir Charles Scareborough, and the line goes on through Jenner, another epoch maker who was in general practice all his life, to our own Mackenzie.

It is then the high prerogative of the family doctor to be considered as the lineal descendant from Greek times onwards of the makers of Medicine; he is in the main stream, he is in the forefront of the battle against disease. The specialist works along the lines of his speciality. For him it is the most important part of Medicine. But the family doctor, by virtue of his central position, must be *au fait* with each and all. While the specialist must "know everything about something," the family doctor in like manner must "know something about everything." The fact is, that a man in good class general practice must be prepared to have his diagnosis revised at any time by a specialist in London or Edinburgh, or Aix, or Harrogate, and his views as to treatment are expected to be not far off those of any one which the patient may select. It is his *métier* then to represent the inherent unity of his Art in the world of medicine and to act as its general interpreter to his patient, and so to hold himself as that Medicine shall always be considered as a self-contained entity and shall never become a mere congeries of specialities.

II.

The Family Doctor as Specialist.—A century ago Medicine in this country was in a rather inchoate condition. There was, it may be said, no true *Corpus* of Medicine. The various schools sent out their men with a licence to practise within a limited area. There was no coherence in the profession—it had not at that time found itself so to speak.

As has been well said: "Prior to the passing of the Medical Acts in 1858 there was no such thing as a 'Medical Profession.' Doctors of Medicine of the ancient Universities existed; physicians existed; surgeons existed and apothecaries existed; but these classes were not a concrete whole and did not recognise each other as professional brethren. . . . There being no 'Medical Profession' it followed that medical men had no status, and their position as a class was extremely dubious."⁵

But the family doctor had by then individually begun to be of some importance socially. The best description perhaps

ever penned of medical doings at that time is to be found in George Eliot's masterpiece *Middlemarch*. Lydgate is a fine character drawing of a man in general practice striving to maintain a high standard of excellence in his work without leaving it to become a specialist. Not only Lydgate but the whole atmosphere of medical life is described with a power unmatched by any writer of the present day. It is now the custom to decry George Eliot with all the other great Victorians. Tastes differ, it is true, in different times. But if we compare, as a modern criticism of medical matters, that clever piece *The Doctor's Dilemma* with *Middlemarch* we shall note the difference. It is that between dignity and impudence. You are profoundly touched by the fullness of thought, the vivid description, the fine attention to detail shown in George Eliot's work; you are, to use the appropriate vulgarism, "tickled to death" by the amusing impertinence of our would-be Molière. Lydgate is a great creation. A man of apparently strong fibre, borne down by the paralysing effect of his mediocre surroundings, he is depicted as a definite failure. He reminds one of another of her creations of Tito Mattei, splendidly endowed with physical and intellectual beauty and power but with a failure of moral sense which brings him to defeat. *Middlemarch* has been called the finest novel ever written, and certainly the atmosphere of the medical life of a provincial town in England has never been so finely drawn as by this great Englishwoman.

Oliver Wendell Holmes, again, a family doctor himself, has given us, in the person of Dr Ketteridge as true a picture as any in literature of the doctor of the time. Holmes from his intimate knowledge of medical men of all classes could approach his subject, as it were, from within. He is not thought of as a great novelist. His poems and essays have outlived his novels. But in his best novel *Elsie Venner* we have the family doctor described in his manner as he lived. Dr Ketteridge, the wise old family doctor, friend as well as physician, shrewd man of the world, astute adviser, cultured scholar, is a fine example of what a medical man might be. Here is his picture: "The leading physician of Rockland was a shrewd old man who looked pretty keenly into his patients through his spectacles, and pretty widely at men, women, and things in general over them. A bald crown, as every doctor should have, a consulting practitioner's mouth, that is, movable round the corners when the case is under examination and both corners well drawn

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down and kept so when the final opinion is made up. When he was listening to talk he was in the habit of looking over his spectacles; if he lifted his head so as to look through them at the person talking he was busier with that person's thoughts than with his words." ⁶

And here is his *Apologia*: "I haven't got a great many printed books; and what I have I don't read quite so often as I might. I'll tell you though, when a man that's once started right lives amongst sick folks for five and thirty years as I've done, if he hasn't got a library of five and thirty volumes bound up in his head at the end of that time, he'd better stop driving round and sell his horse and buggy. I know the families that have a way of living through everything, and I know the other set that have the trick of dying without any reason for it. I know the years when the fevers and dysenteries are in earnest and when they are only making believe." (Had the old doctor been reading Hippocrates' *Epidemics*, we wonder?) And again: "I know these people about here, fathers and mothers and children, so as all the Science in the world can't know them, without it takes time about it and sees them grown up and grow old, and how the wear and tear of life comes to them. You can't tell a horse by driving him once, Mr Bernard, nor a patient by talking half an hour with him." ⁷

These examples of the family doctor of a century ago are from the literature of the time. Let me add one from real life. In a little secluded spot in Banchory, on Deeside, there lived and worked one who, during the whole of a life spent in rural practice, combined the duties of a country doctor with those of a great naturalist and an accomplished scholar. Dr Francis Adams, known to us through Dr John Brown's Memorial Essay in the *Horæ Subsecivæ*, was all these three. A working gardener's son, who at fifteen years of age discovered that "in my early years I had been shamefully mistaught. I began by devoting seventeen hours a day to the study of Virgil and Horace. Having mastered the difficulties of Latin literature I naturally turned my attention to Greek as being the prototype of the other"—a quotation which gives us a taste of his quality and native grit. Here was no mere bookworm, no literary recluse. In a life, not so very long, for he died aged 66 years, he had found time in a busy country practice, carried out on horseback, to write papers on malignant ulcers of the face, on uterine hæmorrhage, on the construction of the placenta, on the treatment of

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burns, and "on a case of dislocation of the knee-joint with dissection." He was also an authority on the birds and flora of the district, and these scientific and medical researches one would imagine to be as much as any man could carry out. But his great work, the memorials by which he will be remembered, are his translations of the Greek classics—Musæus, *Hero and Leander*, Hermes Philologus, Paulus Ægineta, and Hippocrates; these give him a lasting place in the literature of his day, and even yet he is quoted by authorities. And as Dr John Brown says, "If we consider that during this time he was fighting for a livelihood, educating his family and involved in his multifarious and urgent duties, they furnish one of the most signal instances of the pursuit of knowledge under difficulties to be found even among our Scots worthies."⁸ A great position, the Greek Chair, at Aberdeen University was offered him, and titular distinction might also have been his; but both were declined. The instinct to do so was right. He has a monument greater than these in the hearts of his medical brethren, and Pallas Athene may not disdain to look down upon the quiet, far-off resting place of one who was not the least of all her votaries.

Such were the men who a century ago carried on the traditions of Medicine drawn from its deepest springs of Grecian thought and culture. It was at a time of great men in all departments of life, those days when last century was young. But, as has been said, Medicine lacked something. She had not yet become knitted into a coherent whole. Every man lived entirely his own life. Each part of the country was dominated by the nearest Medical School. There was no medical profession, no combined entity to which men could turn and speak as to a representative personality.

About that time this began to be changed, and the prime mover was a graduate of our own University, Charles Hastings, an Englishman of far-seeing vision, who when he went into practice in his own city of Worcester, coming from Edinburgh with its fine atmosphere of sturdy width of culture, of plain living and high thinking, of *camaraderie* betwixt doctors and lawyers and ministers and all cultivated beings, conceived the idea of a society of medical men that should make for "the honour and respectability of the Profession," as the well-remembered phrase has it. The result of his pioneer labours is what we know now as the British Medical Association. Before it there was nothing that bound the members of our

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craft together. Now, it is the outward and visible sign that we are a band of men united in aim and living to some extent in unity with each other. There is a second factor which has been of great help in bringing about improvement in this respect, the passage of the Medical Act in 1858, in which, by creation of the General Medical Council, a certain high standard has been set and maintained; and in this also the British Medical Association, by its furtherance of the movement that ended with the passage of the Act in question, undoubtedly affected much in the way of placing the profession in a sound position in which its rights were maintained and its duties fully insisted upon. By these means we may see that half a century ago the medical man was probably at as high a point in the estimation of the Society of his day as he had ever been. Sir Clifford Albutt, in his Presidential Address at Cambridge, described him thus: "The better class of general practitioner of fifty years ago was rather of the kind of Hippocrates or of Paré than of the modern graduate. His University in the days before great cities was Nature; in his clinical experience he enriched the instructions, half empirical, half dogmatic, of his Medical School by the shrewd, observant, self-reliant, resourceful qualities of the naturalist. His science and his practice were of the naturalist, not of the biologist. He was a woodland guide, not a geographer; but as Aristotle and Darwin well knew, the woodlander gathers much curious lore. However, in the march of intellect this comrade, kindly and loyal as he was, is gone, and his sort of wisdom dies with the individual. Who is to come next? The official doctor, or a family physician more intellectual and no less independent? Every righteous physician regards his practice as a social service, a means not only of bodily but of social reconstruction, and of moral and intellectual health."⁹

Let us note that very pertinent and far-reaching question by this wisest of our old physicians. Who is to come next? Let us pray that it may not be the "Official Doctor" with regulations and instructions all complete: and let us work towards "a family physician more intellectual *and no less independent*."

From this time onwards, however, there arose three factors which have tended towards a decline in the usefulness and therefore of the status of the family doctor. In suggesting the existence of these I am making no complaint against them, for they are not only inevitable but what is of vital

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importance, they all redound to the good of the community and are in themselves beyond criticism. But in my submission the cumulative effect of these, particularly of the last that I shall name, is to have a marked effect upon the efficiency of the family doctor, as I think some are beginning to perceive.

The first was the rise of the antiseptic system of Surgery, involving as it did the growth of surgical specialism. In two ways this tended to touch the family doctor. The province of Surgery, much of which he was previously quite able to traverse, became a vast continent. No one could hope to cover all the ground. Think briefly of what we have seen these last fifty years since I graduated. Brain Surgery, beyond trephining for injury, is all new; that of the thorax, beyond tapping a pleural effusion, is all new; of the abdomen, beyond a strangulated hernia, all new; the surgery of the blood vessels, except for aneurism, is all new; the ear, nose, and throat, and the whole of modern gynæcology, all these were unknown territories, now all in the hands of skilled specialists. It will not be denied that modern advances have mapped out Surgery into not one but many fields requiring special knowledge and training, and incidentally alluring away many of the keener brains and hands that might otherwise now be in general practice.

The second factor is the general tendency towards collectivism in dealing with matters of great public importance such as the prevention of disease. The effect of this is perhaps only fully felt by those of us who have worked through the entire period. The family doctor of fifty years ago was seeing cases of typhoid, perhaps typhus in the city slums, of smallpox, scarlet fever, the venereal diseases, and treating them *secundum artem*. At the present time after making his diagnosis, frequently made for him in the Public Health Laboratory, he notifies his case and sees it no more. He is not called upon to treat it. The Fever Hospital, the Sanatorium, the V.D. Department are employing the trained intelligences which in former days became the family doctors of their day.

The other and most directly deteriorating factor is the National Health Insurance Act. I say this in quite a definite and restricted sense. The basic principles of Health Insurance are sound and valuable. Any man should be able to insure against the risk of sickness and loss of income just as much as against fire or death. The objection taken to it, namely, that it is a form of contract practice, and as such is inherently

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bad, will not stand criticism. The medical services of the Crown are all contract practice, as well as those of the Public Health, and no exception is taken to them. Again, the chief benefit to the working classes of the Insurance system is so great that it is certain to remain and to develop. Before its conception the entire working class knew that should sickness befall, the expense of medical attendance and chemists' bills would fall upon a man with no income to meet them. Now, by a provision to which he contributes, he has all these found him and some sickness benefit in money. His early years of comparative freedom from risk provide for the care that he needs at the other end of life, and further he is encouraged to apply early for advice and treatment so that the National Health service is, in the hands of competent medical men, largely becoming a preventive service, and in the future this will become more and more of social value.

From the point of view of the community, which is naturally and properly the most important and dominating point of view, the system is as nearly an unmingled blessing as can be. But its influence upon that part of the profession which carries out its provisions is not so good, and is one that may tend towards deterioration. Public monies are involved; and on the plea that these must be safeguarded the medical profession is saddled with the responsibility of carrying this out by a system of regulation entirely foreign to it, and tending to check any advance in efficiency in its own proper sphere. Certification on the one hand, and the watch over prescribing on the other, which have been accepted without any serious protest have brought about a state of things which surely no one can have foreseen, or it would not have been allowed at all. A cumbersome form of certificate with regulations to enforce it, which it is safe to say are quite harmlessly broken every day, is the bugbear on the one hand; and on the other the presence of a "Checking Bureau," which is on the alert to insist upon economy in prescribing—well knowing that the chief extravagance is not in the cost of drugs but in the system of payment for chemists' services; these two, with the resulting complaints, exactions, fines, and humiliating experiences before Panel Committees, or even Medical Service Committees, cannot fail to have a demoralising effect upon the panel doctor, who is the family doctor of the working classes, and to degrade him in the eye of the general public. I do not deny that materially he is much better off.

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For him the "Battle of the Clubs" is over and done with, and financially he is on a sound footing, which largely explains the contentment that prevails. But from any but the financial side he is in a miserable plight, tied up by red tape in all directions. All this is foreign to our proper work. In my view the fundamental error in strategy made by the leaders in 1912 was that they forgot that the first and last duty of a medical man is the treatment and prevention of disease. He has no other. Anything else put upon him, certification, prescription checking, recording of every trifling cut or scratch or passing ailment, is a pure waste of his valuable time, time which should be and used to be entirely devoted to the practice of medicine. Instead of which the Approved Societies have got him ensnared as their financial safeguard, and the Government have charged him with responsibility for ensuring economy in expenditure on drugs, with neither of which should he have properly any concern or responsibility whatever.

These three factors then, in my opinion, have brought it about that the men now in general practice have not the standing which used to be accorded to their predecessors of fifty years ago, and this process of deterioration is likely to become more marked as the years go on.

The question then arises before us, have the growth of specialism on the one hand, and the rise of collectivism on the other, left anything whereby the family doctor may be of service beyond the routine work, in which all of us are engaged? There are those who would wish this reduced to its very simplest proportions. Many years ago a bright young fellow of the *Saturday Review* staff delivered himself of the following dictum:—"When the case has got beyond the stage of castor oil or quinine the best family doctor is he who can direct it to the appropriate specialist." Upon which one can imagine the worthy fellow knocking the ashes out of his pipe and marching home to tea, convinced that the last word had been said. He would have felt this still more had he been able to read the recent discussion in the *British Medical Journal* on the theme "Surgery in General Practice." This "hardy annual" usually produces three disputants—the surgeon who would wish everything to be done by the specialist, the family doctor who has not the necessary aptitude for surgery, and the other one who has. Now it is evident that if our *Saturday Review* oracle be right, the doctor will tend to become nothing but a mere medical

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shop-walker, directing customers to the appropriate department. And if the other question be settled in a sense prohibitive of initiative on the doctor's part, then it is easy to see that he must deteriorate more and more. The best men will avoid general practice and the family doctor will become a mere cypher.

There is, however, a way back to a considerable and respectable place in the medical world. The family doctor can, if he wish, be a specialist within his own domain. From the nature of the case he is placed in a position better suited for observation of certain things than any specialist. Let us recount some.

But before considering these we may just touch upon some *a priori* objections that may be taken to the idea of the family doctor as a specialist.

1. The duties of the family doctor are in a sense directly the opposite of those of the research worker. The latter carries out his research, which may not be of any practical value—indeed the idea of its being so is often rather cavilled at—but even if it be so he has no interest in its practical application. The family doctor, on the other hand, is not concerned with the scientific aspect, but very much with the practical results, and it is for him to make himself familiar with these and to apply them in suitable cases. There is thus a clear differentiation of function between the two.

2. From the nature of the case, if it be that a man can find a subject in general practice which specially attracts him, and if he can develop the necessary faculty for scientific research, the likelihood is that he will continue to follow this line of work and thus automatically become a specialist.

3. The last and greatest practical difficulty appears to be that the experience of any one man is so limited that he cannot hope to attain to even a relative share of truth. This appears to be the main source of medical errors, the arguing from an insufficient number of data.

While we may allow that these objections taken together bulk fairly largely, yet we may find that in spite of them there are directions in which very good useful work may be done inside his own domain, in regions where from the circumstances of the case no one else but he has access or opportunity.

I instance five of these developments:—

1. *He may study the Beginnings of Disease.*—This was the burden of Sir James Mackenzie's mission, professed and carried

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out through his long term of work in general practice. For thirty years he worked to show that in the study of the beginnings of disease there was a virgin field, and that the family doctor was the only one who could work it. In the scientific world Mackenzie is probably remembered as the inventor of the polygraph. It cannot be too strongly insisted upon that his claim to lasting fame rests upon the discovery of an Idea and not of an instrument. The idea was this, that instead of trying to learn about disease by studying its end results as shown in the deadhouse, we should study it in its beginning. This idea he devoted the rest of his life to develop, and the James Mackenzie Institute in St Andrews exists to carry it out. It is well worth while to visit that Institute and to see how thoroughly that idea is being explored. Patiently and with perseverance the different signs and symptoms of disease are being considered and the observations tabulated, so that in time a body of evidence may be collated which shall throw light upon the beginning of disease. And while these positive inductions are being made there are not wanting discussions, hypotheses considered, theories propounded. The Scottish spirit is not unlike the Greek in its fondness for speculation, and the historic imagination in listening to these disputations, beside the sea and with the bright sun shining on them, cannot but think of similar groups away back there in ancient Hellas, and the wise old Socrates who led them. Now, all that is being done by men in general practice and what is being done there may, and probably will, in time bear good fruit.

2. *He should practise what we may call Urgent Surgery.*— I am speaking now of the man in country practice far from the great centres, which means, one may imagine, about a fourth of the profession. We are apt to think that the country doctor need not be one to take up difficult cases or to attempt any beyond the mildest forms of practice. A moment's consideration will show this view is not the best one. Remembering the distance from any hospital, the suffering involved, and precious time lost in moving an acutely ill case, it is obviously of advantage, if the rural man be able and willing to do such urgent surgery as may happen to occur. Let us hear the three protagonists I have mentioned. The operating surgeon will tell us that it is for the best interests of the patient that he have only the very best skill. This platitude is manifestly impossible

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of strict fulfilment, and fortunately is unnecessary. The surgeon, like every specialist in Medicine and out of it, tends to magnify his specialty. No one will deny to him that much is work that only he can do. But it is certainly just as true that a great deal of major surgery can be and is done just as well by the ordinary man in good practice as by the surgical specialist. I repeat that such operations as those for strangulated hernia, appendicectomy, suture of a ruptured gastric ulcer, and tracheotomy are all quite within the reach of men in ordinary general practice. Then there is the man who though in general practice prefers not to do surgery. He may be, and often is, an excellent physician, but may not care to assume the responsibility of surgical cases, and probably would be more suitable for practice in the big cities where skilled help can be more readily obtained. There remains the man who is capable of accepting such work. It is all to the public good that such men should be encouraged to undertake it. Let me cite two instances—A country doctor is sent for to a case of laryngeal diphtheria, six miles from his house but close to the district fever hospital. He sends it in without delay. The medical man in charge there is of the type that does not undertake urgent surgery, so that the case has to wait until a specialist can come from the nearest city, and the child is dead before he arrives. Contrast that with the town in which the men are willing and able to deal with urgent surgery. An epidemic of diphtheria occurs, with a considerable proportion of laryngeal cases. Four such cases occur in one epidemic; all are dealt with by tracheotomy in their own homes and all recover, thanks to antitoxin and early operation. Time will not allow of dwelling further on this point; but I could produce instance of all the other lines of urgency which I have named where sound work has been done and lives saved which otherwise would have been lost, had the country doctor not been able to deal with them on the spot. The family doctor then should specialise in urgent surgery, not in the sense of special research, but in that of keeping himself fit to deal with urgent cases as they arise: and with the spread of cottage hospitals, and they should undoubtedly be encouraged to spread over the countryside, this form of speciality will be all for the public good.

3. *Collective Investigation by Men in General Practice.*—This is a form of activity which has for many years been encouraged by the British Medical Association. So far back as 1862 it was

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begun by the Therapeutic Committee of the Association, when Hughes Bennett amongst others took a leading part in supporting it, the subject in which he was chiefly interested being the treatment of pneumonia. In the "eighties" another series of collective investigations took place. Such subjects as the communicability of phthisis, pneumonia, chorea, and others were dealt with, and taking them all over, about 6400 members took part at that time. Quite recently the idea has been revived, and at the moment a Research Committee formed of sub-committees of the Science and Insurance Acts Committees of the Association is, in collaboration with the Medical Research Council and the Ministry of Health, proceeding to start a collective study of subjects on which the men in general practice should have experience, and there may be many on which we should be able to throw light which is evidently not to be had otherwise.

4. *There is again a quite special line of work to which* I wish to direct your attention, as it has not been so far seriously considered by anyone.

Prevention is very much in our minds at present. The regular examination of any machine, whether a motor car or a human being, is a preventive measure which commends itself to any one. Take teeth, for instance—every sensible mother of the educated class takes the family to the dentist regularly, thereby preventing caries and keeping the children in much better health than would be otherwise the case. Now, my idea is that this practice which has arisen spontaneously amongst educated mothers should be adopted generally and systematically for medical purposes as well as dental. Might we not have a system whereby, as in the Child Welfare Centres, the family doctor might begin a *dossier* for the infant, and see the child twice a year as a routine measure. It can be done under State supervision. I feel sure that it might be done without any interference by the State. A committee of the Association could take it up and formulate a scheme, under which the family doctor might by careful and regular supervision be the guardian and watch-dog on the lookout for the beginnings of disease, gradually collecting much information and preventing what so often happens, cases coming after valuable time has been lost. He should have an annual retaining fee for this, which might be fixed by an actuarial valuation of the real risk. I am aware that this is contrary to the present attitude of the

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profession as stated at the representative meeting. But that was in view of possible inclusion of dependants in the National Health Insurance Scheme. This would be independent of Approved Societies and drug fund and suchlike impedimenta. In my submission the idea is a sound one, and if accepted by the laity we might be required to adopt it by them. In view of that possibility we would be wiser to take the initiative ourselves and form a scheme by which the family doctor would be doing a special work of preventive medicine of considerable value to the community.

5. *He may exercise the "Scientific Imagination."*—I grant that this phrase is a "contradiction in terms." Properly speaking science and the imagination are in different mental categories. The imagination is a higher faculty of the emotional order and is exercised by the poet, the artist, and certain high grades of philosophic thinkers; science deals with the measurement of size and weight and with accurate observation; but the phrase is a useful one to denote the deductive method of thought. It has already been suggested that the inductive method, involving as it does prolonged research, is practically out of reach for the man in general practice who seldom sees enough of any one kind of case to form a sound induction. But there is the other method, that of deduction, of synthesis, of the thinking out of an hypothesis, a generality from which one may descend to particulars, the use of the "Scientific Imagination" in effect, just that same deductive philosophy which the late Sir Rickman Godlee, in his fine *Life of Lord Lister*, describes as being "rampant in Scotland."¹⁰ The word intrigues me. It would appear to connote in the writer's mind something of a "tearing, raging propaganda" type, unlike the calm, slow, sure, inductive method. Without entering a caveat against Godlee's contention that Hunter and Lister were both inductive thinkers—and I am of Buckle's opinion that the deductive element was very strongly represented in Hunter's mighty intellect—I would point out that the deductive method, the habit of speculative thought, is one which has been used by most of the men who in general practice have contributed to the advance of Medicine. We think, for instance, of Harvey as of a great experimenter, as indeed he was. But once upon a time Harvey was an obscure physician, struggling for general practice like anyone else, and here is his account of how his great discovery was made:—"When I first gave my

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mind to vivisections as a means of discovering the movements and uses of the heart, and sought to discover these from actual inspection and not from the writings of others, I found the task so truly arduous, so full of difficulties, that I was almost tempted to think with *Frasicatorius* that the movement of the heart was only to be comprehended by God"¹¹; and it was then, away back in 1615, not long after his return from Padua, that he enunciated that child of his fertile brain, the great, the epoch-making pronouncement: "I began to think whether there might not be a *Movement, as it were, in a circle*";¹² and it was not till many years had elapsed, when the experiments had been made which proved his original idea to be correct, that it was made known to the public and to the world. An inductive philosopher would have done the experiments first and from them deduced his explanation: Harvey tried to do so, failed, thought out his hypothesis and did the experiments to prove it.

Jenner also, when in general practice so far back as 1780, nineteen years before the publication of his enquiry, had thought out his theory of the relation between smallpox and cowpox as shown by this quotation from Baron's *Life*:—"He (Jenner) was riding with Gardner near Newport when the conversation passed of which I have made mention. He went over the natural history of cowpox, stated his opinion as to the origin of this affection from the heel of the horse; specified the different forms of disease which attacked the milkers when they handled infected cows; dwelt upon that variety which afforded protection against smallpox; and with deep and anxious emotion mentioned his hope of being able to propagate that variety from one human being to another till he had disseminated the practice all over the globe, to the total extinction of smallpox," Baron, p. 128.¹³ Jenner then had thought out his theory of the causation of smallpox before amassing the facts that were to prove it, and in so doing he worked upon the deductive method just as Harvey had done.

Sir James Mackenzie, too, was a speculative thinker. Finding, as he tells us, that in practice there were many conditions for which no explanation had been shown him as a student, he began to think them out for himself. He was always on the search for a principle to guide him. One of these, the principle, namely, that all symptoms of disease are the result of disturbed reflexes, is a pure deduction and its truth is being

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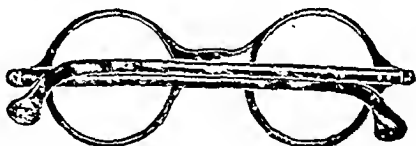
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gradually searched for in the discussions and observations in the Institute.

Lister himself (*pacc* Sir R. J. Godlee) is another instance. Pasteur had laid open to the world the mystery of micro-organic life. The flash of "scientific imagination" suddenly revealed to Lister the fundamental thought, "Pasteur germs may be the factor for which we are looking," and another epoch-making discovery was born.

That the deductive philosophy bulks largely in the history of thought in Scotland will be clear to anyone who studies that portion of his massive work which Buckle devotes to Scotland, the third volume of the *History of Civilisation in England*. The most striking instances are those of Cullen, Hunter himself, and Adam Smith, all of whom were essentially deductive thinkers. Moreover, some of the greatest of all Englishmen, Newton, Harvey himself, and Spencer, whose intellect was probably the widest in point of range of thought since Bacon, were of the same type of mind; therefore perhaps it may be said that the deductive method is one which may fairly be used in Medicine. My point here is, that the family doctor being debarred by the small extent of any one man's direct observation from pursuing the inductive method may, and does sometimes do something by speculative reasoning in effecting some advance in Medicine. What was James Mackenzie but of the deductive cast of mind. His generalisations were the result of abstract thought; having thought them out he worked them out in practice; such a sequence is essentially of that class which Godlee found to be "rampant in Scotland."

Let us take some concrete cases. In the early "seventies" a Dundee doctor—T. J. MacLagan—was thinking out a remedy for rheumatism and here is what his line of thought came to. "A striking thought in the natural history of the malarial fever is that the trees which provide their cure grow best in the localities in which those fevers most prevail, Nature seeming to produce the remedy under climatic conditions similar to those which produce the disease. In rheumatism a low-lying damp locality and a temperate climate present the conditions most favourable to its occurrence. Looking about for a plant or tree which most flourishes under such conditions, that which naturally presented itself was the willow—the various species of *Salix*. Among the *Silicaciæ*, therefore, a remedy for rheumatism was sought. The bark of most willows contains

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a bitter principle called Salicin. This seemed what was wanted. . . . It was accordingly tried. The results exceeded all expectations." ¹⁴

Since which time Salicin alone or in combination has been the chief remedial agent in acute rheumatism.

Let us take another, from the work of one of your most distinguished fellows. In the second volume of his *Clinical Studies*, Sir Byrom Bramwell in writing of psoriasis has the following remarkable statement. "In the first case of myxœdema in which I employed the thyroid treatment I gave the raw gland and I gave far too large a dose. The result was the production of acute thyroidism. The myxœdematous symptoms were rapidly removed, and the skin desquamated freely. Practically speaking the patient got a new skin. I was very much impressed with the desquamation, with the improved nutrition of the skin, with the rapid growth of hair, and with the restoration of the sweat secretion; and I said to myself, if thyroid extract can produce such a remarkable result on the nutrition of the skin in myxœdema, it will probably be useful in the treatment of skin diseases. I therefore decided to try the remedy in cases of skin disease. This was the first case in which I employed it. The result was extraordinary. It altogether exceeded my expectations. Now I wish you to note that I was led to try the effect of thyroid extract in diseases of the skin, not as a mere chance experiment, but with a definite therapeutic purpose. The extraordinary improvement in the nutrition of the skin which it produced in cases of myxœdema suggested that the remedy might prove useful in some skin diseases." ¹⁵

If I may, without impropriety, instance a line of thought which I have worked at myself it is, I think, an instance of the deductive method applied in Obstetrics. The endeavour is to find an explanation of the unquestioned mortality from sepsis in puerperal cases. For fifty years this has been regarded as a matter in which the antiseptic system should play a part in reduction of mortality, and it is asserted that no such reduction has taken place. This alleged fact is held up as a reproach to the medical man, particularly to him in general practice, and some explanation of it is demanded of him. I have shown from statistics that it is not true that no improvement has taken place; it has. But that there is still a residuum of mortality is undoubted, and on considering

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this, with many cognate facts such as that if a tuberculous woman becomes pregnant she keeps well till her confinement, and then dies rapidly from tuberculosis; if she be the subject of heart disease she will die, not from the strain of labour but afterwards; that *post-mortem* cuts received in dissection of a puerperal body are notoriously more fatal than other wounds received in *post-mortem* examinations, showing the increased virulence of the organism; I formed the hypothesis that we may have in the pregnant woman a subject in which the immunity from disease and particularly from sepsis is not increased but decreased, and that in this unsuspected factor of a diminished resistance we may find an explanation of the mortality which, with every precaution that we can take, remains with us. It has been shown since that paper was written that we may cease regarding the pregnant woman as just an ordinary healthy woman about to have a baby; her blood conditions, her endocrine balance, her internal organs even are definitely altered, and the striking fact is, that so far none of these alterations appear to lie in the direction of defence mechanisms.

The recent research of Hynd in the source of the protein in albuminuria of pregnancy, if corroborated, will tend to show that this is formed from the mammary secretion itself, this being quite other than a defence mechanism.¹⁰

This is not the occasion on which further to elaborate this theme. It is used as an instance, like the others, of the way in which the speculative mind may draw deductions of value from a limited series of facts; and in the matter we are considering of the ways in which the family doctor may be of use in his day and generation, this method may serve a purpose.

Akin to this is that valuable asset to any man in general practice or other, a sound "clinical instinct." It is probably the most valuable mental quality that any one can have, the quick intuition that goes straight to the point *acu rem tetigere*. Curiously, like the "card sense," it is found often in not very intellectual people. Every teacher of medicine can probably remember students, not very gifted otherwise, who have the faculty. The old "handy wife" owes much of the grateful recollection of her to this gift. It is probably a survival of the primal instinct of rapid deduction from a few sparse and almost imperceptible data which is still to be seen in primitive people.

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Jenner has a few observations bearing on this:—"A man must be guided by his own genius. . . . Something new is forever presenting itself—neither books, lecture, nor the longest experience are sufficient to store his mind with the indescribable something a man of our profession should possess."¹⁷

In five directions then, and there may be more, the family doctor may do useful work, and in areas which he has practically all to himself, namely:—

The early symptoms of disease.

The urgent surgery of country districts.

Collective investigations of those diseases which do not present themselves to the specialist.

Observation during health of his patients with the view of prevention, and—

The thinking-out of medical problems such as those of which samples from actual practice have been given, "the scientific imagination."

Work such as this is well worth the attention of the members of our body who wish to maintain the standard set by the generations of men before them. The times have changed and we have changed with the times. It is almost a truism to say that new laws tend to produce results never dreamed of by their makers. This applies, I suggest, to the National Health Insurance Acts. No one thought of them as tending to change fundamentally the main activities of the profession. And yet it is as I have indicated above. The doctor's time is so much taken up with records of trivial events, with writing certificates, writing and re-writing prescription forms, largely, if not entirely, for the convenience of the Approved Society officials, and for prevention of fraud by chemists, that a very substantial part of his time, which should be given to nothing but the practice of Medicine, is wasted, and he is becoming merely an official concerned in administration of funds, work which could be done by lay people and done quite as well. It is work foreign to him, he is not as a rule a good business man, and he often does it carelessly, with the result of "breach of regulations," censure, perhaps fine, and in any case a lowering of his prestige as a member of a profession whose proper work is on a higher plane, and which he probably does as well as anyone. May it be found possible some day to hark back to the fundamental truth that the doctor's work is the treatment of disease and nothing else.

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III.

The Ethos of Medicine.

The family doctor has yet another use. Not only is he the high priest of Hygiene, not only are there regions in Medicine where he will be the first and perhaps the only worker; he stands in a very special position in regard to his patients, a position quite separate from the professional one. He is in a kind of way the nearest approach to a Father Confessor that we, in these times, may see. His work brings him into very close relationship in many a home. "For the medical man sees terrible sights, touches unpleasant things, and the misfortunes of others bring a harvest of sorrows that are peculiarly his."¹⁸

The doctor who is never consulted about anything but sickness must be a rare phenomenon. I am not thinking now of the Health Insurance business—we have often enough to interpret its difficulties to our patients. But in many aspects of life, legal matters, what to do with the boys, what to do with the girls, all sorts of things are brought to the doctor for his advice. Thus we probably have as full an idea of the lives of the people, of their wants and difficulties, as most. Again, we doctors do live in a strange environment of disease and pain and weakness, amongst "disharmonies" of every physical and psychic kind. From one sickroom to another we pass our days and nights in attendance on the sick. Our work is largely with the unfits and misfits of life, seeing to refit them more or less for the work they have to perform. The great mass of healthy folk, who never need our aid, are outside our purview. The statistics of the Health Insurance people show us that about 1 per cent. per annum gets a prescription from us. We work, therefore, in a curiously restricted area; we live in an artificial world of disharmonies. What is the effect upon our minds?

On many of us it has none. By a merciful provision of nature most men in general practice do not dwell upon the sad, or tragic, or revolting aspects of the medical life. They do their duty, and there it is—all in the day's work. Further, most men have wisely some other interest, be it golf or shooting or bridge or what not, which is a salutary counterpoise. But there must be some who think it out and try to evolve some explanation or reason for all these disharmonies. What is the

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good of this perennial struggle of mankind against its environment of disease and suffering?

As usual in all great questions we may well go back to Greece to find the first questionings and the noble responses. And just as there are two classes of thinkers always with us Platonists and Aristotelians, Idealists and Realists, so in this quest we find those who hold that happiness is the prime object of man, and his proper lot to which he is entitled; the Epicureans; and what without begging the question one may call the nobler sort who hold that to look for happiness merely is to pursue a chimera which will never be found, or if so will only disappear; the Stoic. It would appear that one or other of these must be our choice, and in these days surely the Epicurean would gain a clear majority vote. A recent medical writer lays this down very strongly and in the following language:—"I wish to stigmatise as a devilish and cruel falsehood the notion that pain and suffering are good and are essential to our development. 'There is something fine and ennobling in suffering; it helps to mould our character and fashion our soul and brings us in harmony with the divine will'—thus writes a correspondent. Oh! Cruelty and stupidity of it all! Who can calculate the amount of actual suffering this cruel and insane dogma is responsible for? If suffering and pain are good and noble and useful, why attempt to do away with them? Why not wait till the sufferer has had a good dose of them? Let those who have the atavistic cruelty of the primeval beast in their breasts say what they will, I affirm, and will solemnly maintain with my last breath, that there is nothing good and noble in suffering, that its influence on the race is wholly bad; that it is poisonous both to the body and mind; a cause of degeneracy, decay and death."¹⁹

Such a pronouncement is rather typical of the state of thought to-day. The atmosphere is one of conscious seeking of pleasure, in dancing, in music—of a sort—in pleasure anywhere and everywhere. It is worth suggesting that this is a passing phase, recurrent at certain periods of our history? And yet so it is. The Puritan domination of the seventeenth century, the Restoration, and the Napoleonic Wars, all in turn have been succeeded by the like phenomenon, recurrent like the swarms of midges after rain and about as evanescent.

For the spirit of man is built for nobler things. There is

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that in the Stoic philosophy which finds its counterpart amongst the finer races of mankind at all times and places, the instinct namely that the pursuit of self alone brings no real and lasting satisfaction; that something else is wanted, the Other than self, devotion to which brings a satisfaction not present with the Epicurean. The same instinct is found elsewhere indeed, not only with Zeno and Epictetus and Aurelius.

There is in man the sure knowledge that suffering is not all to the bad, that to endure is to become strong, that the plaint of Faust

"Entbehren sollst Du ; sollst entbehren"

has some justification if the race is to maintain its high traditions.

Let us look at it. Where are the great ones of the earth reared? Not in the lovely isles of the sea or in the tropical belt where Nature is so lavish with her gifts that man has nought to do but eat, drink, and be merry. It is in the rugged hill countries where Nature is harsh, and brings up her sons enured to cold and hunger and fatigue, that the finest races are found, the Spartans of Thermopylæ, the Vikings of the North. What does our family doctor find? Which are the happiest of his patients, the one-family child, carefully nurtured and defended, or the household of bairns that grow up just anyhow? Look again at the sickbeds that we know of, of patients often racked with pain. How patient, how thoughtful of others, how resigned to suffering are these. Remember the days of the Great War. Can you recall, without a catch in the throat, the light that shone in the eyes of those mere boys coming down, sorely wounded, after long days of suffering in the trenches and at the dressing stations; if the spirit of man were not in them, being "made perfect through suffering," then there was no meaning in those eyes. No, the Stoic has it. There is in man something more than the quest of happiness. That quest finds its fruition easily, and its end is not peace but mere satiety. The other, the Not Self, is it not that for which our art exists? We, its votaries of all grades and branches, are we not guided by the same instinct of devotion of unselfishness, of service? But this is not and never was confined to us and to our craft. That same instinct of self-control, of inhibition of the lower impulses, shows itself alike in the stoical North American Indian, in the Saumauri of

Charles E. Douglas

Japan—Bushido—in the English Public School man, in our Presbyterian forebears, and in the Greek Philosopher.

Let us recall the teaching of Epictetus. He like other great spirits wrote nothing and is only known to us by Arrian's reproduction of his words, and this appears to be more of an exact taking of notes than the corresponding finished literary essays by which Plato has reproduced for us the sayings of Socrates. But even so they have a fine, rugged eloquence of their own. Here is a sort of summing up of his teaching on how we should use our faculties: "Man, the purpose set before you was to make yourself capable of dealing with the impressions that you meet as Nature orders, so as not to fail in what you wish to get, nor to fall into what you wish to avoid . . . free, unhindered, unconstrained, conforming to the governancy of God, obeying this, well pleased with this, criticising none, blaming none, able to say these lines with your whole heart."

"Lead me, O Zeus, and thou my Destiny." ²⁰

Think of him, poor, a slave, lamed for life by the cruelty of his master; read his epitaph—

"Slave, poor as Irus, halting as I trod,
I, Epictetus, was the Friend of God." ²¹

Think of that refrain, ever occurring in his teaching—

"Lead me, O Zeus, and lead me Destiny
Where'er ordained is, by thy decree
I'll follow, doubting not, or if with will
Recreant I follow, I shall follow still." ²²

These are not his own words. He was not a poet. They are a quotation from Cleanthes, another Stoic, and we see in them quite clearly the same idea as that in Newman's "Lead, kindly Light"; in fact there is reason to believe that they were in Newman's mind when he wrote that noble hymn.²³

To sum up then. We may look upon the family doctor as the inheritor and curator of the truth that Medicine has a corpus of its own, which must not be allowed to become a mere congeries of specialities; that in this territory he has sphere of activity all his own in which he may find freedom from the paralysing influences of officialdom. In this scheme of things there is but little room for self but plenty scope for service—width of culture, keenness in work, depth of sympathy with the needs of poor humanity—such are his aims. They were those

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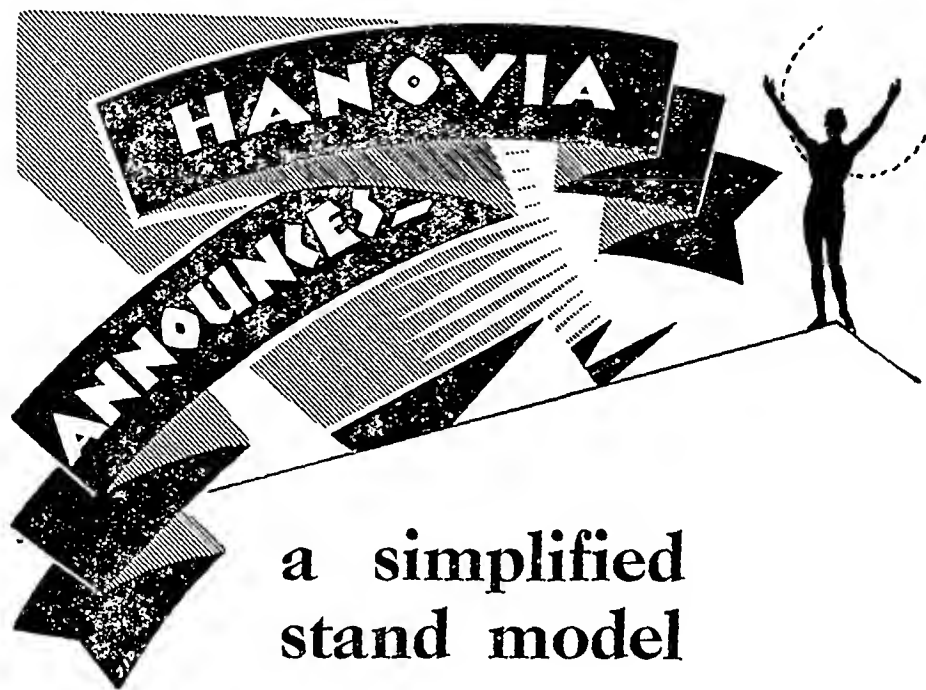
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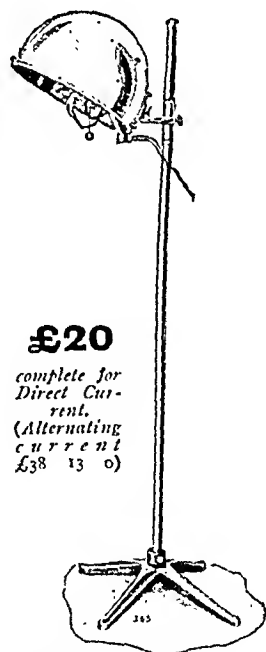
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of Alexander Black, in memory of whom these words are spoken, in memory of a scholar of refinement, who for his living pursued the Art and Craft of Medicine.

Thus we arrive at a vision of the family doctor. He is the heir of all the ages, of Hippocrates and before him; with these he inhabits the main road on which the advance of Medicine is journeying. It is his to travel on lines where he is nearer to the heart of humanity than any but his ancient ally, the minister of religion; like him he sees things and feels experiences known only to them and to the people in whose homes he knows of deeds of quiet heroism, of suffering borne in silence, of self-sacrifices, of many things never published to the world. He salutes with reverence the Spirit of Humanity, for he knows, because he has seen, that that Spirit is stronger than the pains and troubles of this mortal life; that there is nothing, not pain, nor hunger, nor weariness, nor the haunting dread of death and the Invisible, that the spirit of man will not surmount and find itself the conqueror, not once and now, but always and to the end.

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DIGITALIS ACTION AND CONTROL OF THE PULSE RATE.

By D. M. LYON, M.D., D.Sc., and A. R. GILCHRIST, M.B., Ch.B.

(*From the Department of Therapeutics, University of Edinburgh.*)

DURING the past two years we have been engaged in making a clinical comparison of the relative strengths of three preparations of digitalis issued by the Hygiene Committee of the League of Nations. Analysis of the data obtained has yielded some interesting information regarding the laws governing the response to the drug.

Methods and material.—In order to obtain clear cut results for comparison of the different samples, it was decided to administer powdered digitalis by the body weight method of Eggleston previously described in this *Journal*.¹ Observations have been made on patients suffering from various types of heart disease in different stages of compensation or failure. Certain individuals with normal cardio-vascular mechanism have been employed as controls. Every care was taken to see that the effects of rest and of other treatment were not confused with those due to the drug. Patients suffering from pyrexia or from hyper-thyroidism react abnormally, and figures from such cases have been excluded.

By the massive dose method of administering digitalis, each patient receives a similar amount of the drug in proportion to his body weight. Despite this uniform dosage, wide differences are found in the degree of response produced. Many clinical observers have called attention to this curious variability, and some have pointed out that cases of auricular fibrillation give more consistent results than those with normal rhythm. The careful observations of Mackenzie² showed that the response to digitalis depended to a great extent on the condition of the heart at the time the drug was given. This fact becomes evident when our findings are plotted graphically. In Figs. 1 and 2 the base line shows the initial value of the heart rate before digitalis was given, while the vertical scale records the maximum amount of slowing produced in each

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case. A direct relationship between the two is at once evident, larger effects on the pulse rate being obtained as the initial

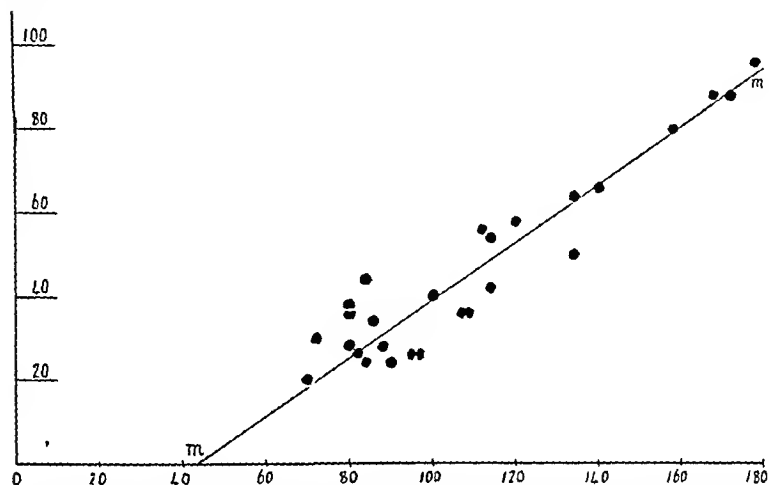


FIG. 1.—Results of massive doses of digitalis (sample C) in cases of fibrillation. Abscissa—initial heart rates, ordinates pulse slowing. The line *m—m* indicates the most probable values of the slowing to be expected.

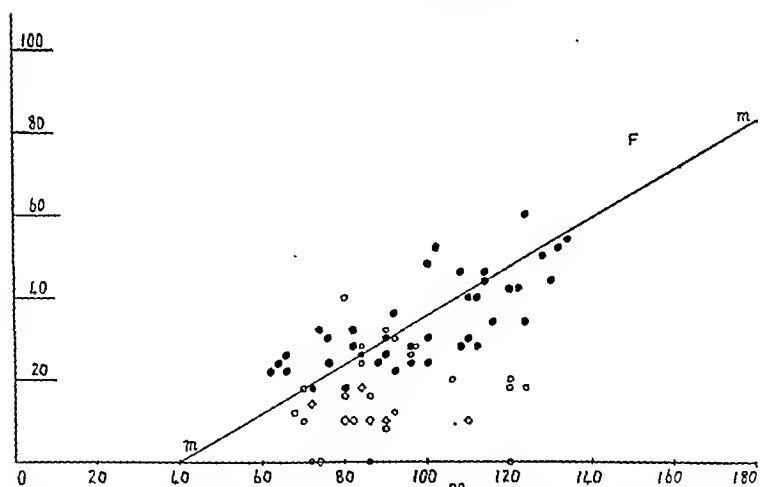


FIG. 2.—Data obtained by use of digitalis B. Fibrillation results shown thus—●; non-fibrillating heart cases, ○; subjects with normal hearts, ◇. An isolated observation on a case of auricular flutter is indicated by F.

values rise. Another fact revealed by these figures is the marked difference between the results from fibrillating and

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from non-fibrillating patients. In practically all instances for any given pulse rate the fibrillating subjects react more vigorously than the others. Few patients, other than those with auricular fibrillation, have a pulse slowing of more than twenty beats even under full doses of digitalis. Some, indeed, show no change in pulse rate, while a few actually accelerate. This lack of uniformity on the part of the non-fibrillating cases indicates that they, at least, follow no single rule. With the fibrillators, however, the matter is different. In an earlier paper³ based on fewer observations, it was suggested that

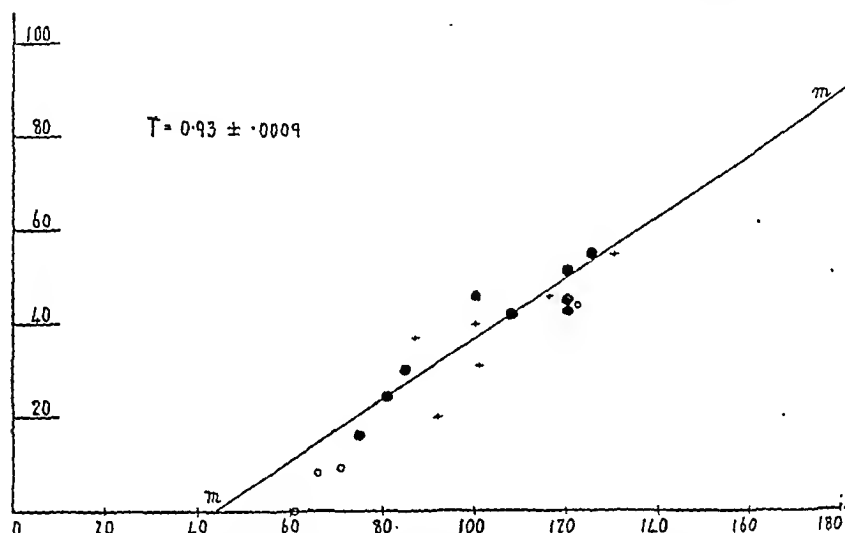


FIG. 3.—The best value line $m-m$ is derived from data for cases of fibrillation in the paper of Cushny, Morris, and Silberberg (shown as ●). Non-fibrillating cases in this series are shown as ○. The remaining points (+) are taken from the paper of Lewis. In both series digitalis was administered by the slow method.

the response to digitalis might follow a law of "growth" type. This has not been substantiated, for of several mathematical expressions tried, a straight line formula ($S = aP + b$) was found to fit the facts best. This law shows that the amount of pulse slowing (S) is a direct function of the initial pulse rate (P). A very high degree of relationship (r) was found to exist between the two variables. The derivation of this expression is more fully discussed elsewhere.⁴ Fig. 3, constructed from data in the paper of Cushny, Morris, and Silberberg,⁵ has a similar form, the subjects in this series being fully digitalised by the small dose method over several days. In these three figures the best value line $m-m$, derived

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from the above formula, gives the mean values of pulse slowing for all levels of initial heart rate. It will be noticed that in each instance this best value line crosses the base in the neighbourhood of 40 to 44. At this point no slowing results, while theoretically below this value acceleration would occur.* It is significant that when the chambers of the heart are dissociated by complete heart block, the isolated ventricles continue to beat independently to about 40 per minute.

Control of the heart rate.—Before examining the mode of action of the drug it will be of value to review some of the principal factors which influence the heart rate. All portions of the cardiac muscle possess the inherent faculty of rhythmic contraction, though this property varies in degree in different parts. The basic rate of the independent ventricles in man is usually between 30 and 40 per minute, while the natural period of the sino-auricular node is more than twice as fast. The more rapidly beating area tends to impose its rate over the whole heart, normal impulses arising in the pacemaker (sino-auricular node—S.A.N.) spreading over the auricles and then via the auricular ventricular node (A.V.N.) and the bundle of His to the ventricles. The arrangement might be likened to the physical phenomenon "forced vibration," where, for example, a free swinging pendulum with a natural period of 40 had its rate increased to 80 by a more rapidly acting external force. The S.A.N. itself, however, is not entirely independent, for while its natural rate is somewhat higher it is actually damped down to the neighbourhood of 80 by impulses carried by the vagus. The existence of this damping action permits of rapid acceleration when the governing influence is slightly relaxed, as on excitement or on muscular effort. The cardiovascular system is one of the most plastic and responsive in the whole body and the pulse rate readily changes under many conditions, both in health and in disease. Besides the effects of alterations in quality of the blood⁶ and in the body temperature,⁷ the chief factors are probably "effort" and "nervous influences." Cardio-acceleratory and cardio-inhibitory centres have been described in the fourth ventricle. Acceleratory and augmentory fibres pass to the heart by the sympathetic system; depressing and inhibiting messages are sent by the vagi.

* Note that when complete heart block has been produced experimentally in animals further digitalis causes quickening, usually attributed to increased irritability of the ventricular muscle.

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Branches of these nerves are distributed principally to the S.A.N. and the A.V.N. and to a less extent also to the muscle of the different chambers. As in other regions, sympathetic and vagal activities act reciprocally, stimulation of one being accompanied by depression of the other. The emotions for the most part cause sympathetic stimulation with cardiac acceleration and augmentation (excitement, rage), less often vagal activity dominates the picture, resulting in cardiac depression, slowing and enfeeblement ("shock," intense fear). Several reflex mechanisms are associated with the changes called forth by effort. The aortic (depressor) reflex regulates the pulse rate in accordance with the height of the blood pressure in the first part of the vascular tree. When the B.P. rises afferent impulses pass by the vagus to the brain and thence to the heart, causing slowing. Probably the most important regulatory mechanism is that known as the Bainbridge auricular reflex. This controls the heart rate and output according to the amount of blood returning to the right side of the heart. Anrep and Segall⁸ point out that this reflex involves the cardiac centres in the brain, for it is not present in isolated preparations. The exact paths involved have apparently not been fully worked out. Bainbridge⁹ thought that although the vagus was principally concerned, the sympathetic also played some part in it.

Pulse rate control in disease.—The governing factors described above have been principally studied in healthy subjects, both man and animal. It is possible that they may be modified or altered under disease conditions. The nerve mechanisms are probably intact in cases of heart disease without fibrillation, although certain paths may be either more excitable or less active from overstimulation or from fatigue. In patients who have a weak myocardium, exercise accelerates the heart to a greater extent, and the increased rate persists longer than in normal individuals. Mackenzie and his co-workers have repeatedly shown that the symptoms of disease are for the most part altered reflexes. In health the heart rate reflexly responds to demands made by the body. If greater effort is required, the heart is hastened by means of the Bainbridge reflex, extra blood returning from the active muscles serving as the stimulus. As the myocardium fails and the circulation becomes inefficient, more blood accumulates on the right side of the heart, and acting through the same reflex mechanism

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produces cardiac acceleration. It is well recognised that as a general rule the rapid pulse of heart failure serves as a measure of the inefficiency present. This may not be the whole truth, however, for despite the serious degrees of breach of compensation which may occur in hearts with normal rhythm, the pulse rate in them is seldom as high as in cases of fibrillation.

Where the nervous mechanism is intact, the final path of the Bainbridge reflex must be via the vagal and sympathetic fibres to the S.A.N. Some other acceleratory mechanism must also be available, for similar changes of rate take place in cases where the S.A.N. is no longer in control of the heart. Take the case of a patient who suffers from *complete heart block*. The details are shown in Table I. The ventricle beats at all times

TABLE I.

| | Auricle. | Ventricle. | Percentage increase over Resting Values. | |
|--|----------|---------------|--|------------|
| | | | Auricle. | Ventricle. |
| Basal | 80 | 39.2 | ... | ... |
| Resting | 80 | 39.2 | ... | ... |
| Figures | 80.6 | 38.2 | ... | ... |
| | 81.3 | 38.7 | ... | ... |
| | 79.4 | 37.5 | ... | ... |
| | 80.4 | 37.8 | ... | ... |
| Averages | 80.3 | 38.3 | | |
| | | | Per cent. | Per cent. |
| After five minutes' exercise | 130 | 46.8 then 61* | +63 | 23 to 59 |
| Five minutes later | 116 | ... 56* | +45 | 46 |
| Ten minutes later | 106 | ... 53* | +32 | 38 |
| Climbed stair | 129.6 | 47.3 | +63 | 24 |
| After further climbing | 112.6 | 56.6 | +41 | 49 |
| Five minutes later | 92.3 | 39.7 | +15 | 4 |
| Seven minutes later | 92.4 | 39.7 | +15 | 4 |
| Ten minutes later | 90.2 | 40.2 | +12 | 4 |
| Mental effort | 112.4 | 45.1 | +40 | 19 |
| Pain threatened | 95.4 | 41.1 | +19 | 8 |

* Figures marked with asterisk are ventricular rates after appearance of alternate extra-systoles of ventricular origin.

quite independently of the auricles, yet it accelerates under the usual nervous stimuli, as well as on effort and during fever. Both auricles and ventricles quicken after strenuous exercise, but although the same stimuli would be available for both, their degree of response is different (though somewhat similar when

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numerous extra systoles were called forth). Similar unequal increases were induced by the mental effort of adding columns of figures, and by the threat of physical pain. These experiments show that although the ventricles are quite dissociated from the S.A.N. and the auricles, they still remain under nervous control—probably via the branches distributed to the A.V.N. de Graff and Weiss,¹⁰ who reported a study of the nervous control of the heart in eight cases of complete heart block, concluded that the vagi continue to exert a slight inhibiting effect on the ventricle in that condition. With regard to the effect of exercises (25 knee bends), they uniformly found auricular acceleration as in normal individuals but no alteration in the rate of the ventricle.

In *partial heart block* conduction between auricle and ventricle has become so depressed that successive impulses find greater and greater difficulty in passing, and every third or fourth fails altogether to cause a ventricular contraction.

The conditions present in *auricular flutter* are of special interest. The S.A.N. is apparently quite without influence on the heart rate, but instead a rapid succession of regular waves pass over the auricles and reach the junctional tissues. These contractions are usually between 250 and 350 per minute, and are but little influenced by nervous stimuli, whether resulting from effort or from emotion.¹¹ * The ventricles, however, continue under reflex control, accelerating with muscular activity and under mental stimuli. Sometimes the ventricular contractions show the unequal spacing characteristic of respiratory irregularity, indicating alternating increase and diminution of vagal tone. When this is present, usually on deep breathing after effort, there is no regular time relationship between one ventricular complex and the preceding auricular wave. In Table II. the intervals vary from 0.02 to 0.20. More usually the condition is one of pure flutter where a definite time interval exists and remains constant over long periods, showing that the auricle is still influencing the lower chamber to some extent. For example, a rhythm of $A : V = 4 : 1$ at rest may be converted into a regular $3 : 1$ ratio as the result of effort. Apparently the approximate speed of the ventricle is controlled

* Lewis, Drury, and Bulger¹² state that a gradual acceleration of rate appears to be the commonest reaction of the fluttering auricle to vagal stimulation, but it is not often seen in an uncomplicated form unless the stimulation is weak. See also Wilson.¹³

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by the Bainbridge reflex, while the actual moment of each contraction is determined by the arrival of one of the auricular impulses. When auricular flutter is present the ventricular complexes in the electro-cardiograph are still of the "supra-ventricular" type, which indicates that the impulse enters the ventricle from the A.V. node as in normal conditions. The reflex mechanism influencing the ventricular rate and the auricular impulses precipitating the contraction must both act on the A.V. node. It is often stated that in auricular flutter and in fibrillation there is an interference with the conducting

TABLE II.

| Date. | Condition. | Auricles. | Ventricles. | f to r interval. | Remarks. |
|-----------|------------------------------------|-----------|-------------|------------------|---|
| 29th Dec. | At rest . . . | 279 | 69 | 0.209 | Pure flutter 4 : 1 |
| | " . . . | 265 | 60 | ... | Two cycles 6 : 1 |
| | After five minutes' exercise . . . | 269 | 99 | 0.02 to 0.163 | R.I. present. Mostly 3 : 1 |
| | After ten minutes' exercise . . . | 287 | 103 | 0.07 to 0.220 | " " " |
| 30th Dec. | At rest . . . | 292 | 62 | 0.04 to 0.200 | R.I. present. Six cycles 4 : 1, three 6 : 1 |
| | After five minutes' exercise . . . | 276 | 92 | 0.209 | Regular flutter 3 : 1 |
| | Later . . . | 285 | 78 | 0.207 | 8 (4 : 1), 2 (3 : 1) and 2 (2 : 1) |
| 5th Jan. | At rest . . . | 268 | 67 | 0.177 | Regular flutter 4 : 1 |
| | After five minutes' exercise . . . | 267 | 89 | 0.167 | Nearly all 3 : 1 |
| 6th Jan. | At rest . . . | 448 | 67 | ... | Now fibrillating |
| | After exercise . . . | 448 | 89 | ... | ... |

The patient had no digitalis during the period included above nor for 12 days previously.

mechanism between the chambers. This, however, is of quite a different character from that existing in partial heart block. Doubtless some of the impulses arrive while the ventricle and the A.V. tissues are refractory and are thus neglected, but it would appear that there is in addition some arrangement protecting the ventricle from undue stimulation and consequent overaction. This mechanism is not a passive result of the refractoriness of the tissues, and as we have seen above appears to be to some extent under the control of the nerves acting on the A.V. node and bundle.

The problems in the allied condition *auricular fibrillation* are very similar, though the auricular changes are not so easily

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traced in the electro-cardiogram. The principal difference lies in the very much greater number of independent movements in the auricles and in the inequality of these in strength and rhythm. Many are so weak that they scarcely deflect the galvanometer and some may never reach the junctional tissues. So frequent are the showers of stimuli that some must occur during the refractory period of the ventricle and these must be neglected in any case, even if they could pass the junctional tissues. A part, at least, of the difference between ventricular and auricular rate must be attributed to refractoriness of the tissues. It is clear that emotional stimuli and muscular demands can alter the ventricular rate without any *corresponding* change occurring in the auricles (Table II).^{*} Direct pressure over the vagus trunk in the neck or over the eye results in similar independent slowing of the ventricular movements. These facts indicate that the ventricle is still under efficient nervous control. Apart from electro-cardiographic evidence that the ventricular contractions are started by impulses from the A.V. node, the influence of the auricles in cases of fibrillation must be inferred from analogy with the allied condition of flutter.

The question of the occurrence of partial block due to refractoriness is discussed by Lewis,¹⁶ who showed in animal experiments that when the auricles are induced to fibrillate by electrical stimulation, the ventricles are unable to follow because of the relatively long refractory period of the A.V. node. This refractoriness varies with the rate of auricular impulses, being much enhanced as the stimuli increase in number. The A.V. intervals begin to lengthen as rates of 200 to 250 are reached. At higher rates this lengthening becomes considerable, and failure of the ventricle to respond occurs about 300 to 350 when the block developed is sufficient to cause occasional beats to be dropped. As he points out, similar conditions are probably present in clinical fibrillation. Wright¹⁷ also draws attention to the relatively long refractory period of the A.V. tissues, and states that they cannot transmit more

* Baumgart¹⁴ examined the effect of exercise in a large number of cases of auricular fibrillation and showed that while ventricular acceleration occurred there was usually a slowing in the rate of the auricle. He points out that this contrast follows the rule laid down by Lewis¹⁶ that in auricular fibrillation the changes in rate are in opposite directions in auricle and ventricle.

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than about 270 impulses per minute. All stimuli in excess of this must be lost because of this refractoriness; the remaining 270 must either be passed on to the more responsive and less refractory ventricles which could actually respond to 300 to 350 beats, or else must be actively diminished by the "conducting" tissues. The ventricle in patients with auricular fibrillation would appear to be protected from overstimulation by at least two mechanisms: (a) partial block due to refractoriness of the A.V. tissues and (b) a nervous influence on the conductivity of those tissues. Other factors controlling conductivity may also exist. It is interesting to contrast the relatively poor conductivity of the A.V. junctional tissues with that of other parts of the heart and specialised conducting tissues. The rate of impulse propagation in the A.V. node is but 0.2 m. per second, as compared with 0.4 m. for the ventricular muscle, 1.0 m. for the auricle, 4.0 m. for the Purkinje fibres, and 200.0 m. for nerve. This part of the heart is therefore the weakest link from the point of view of conductivity, and is also the place where this function can be most easily controlled by nervous influences. The low grade of impulse propagation might suggest that one of the chief functions of the A.V. tissues was to act as a variable resistance or filter, and that this resistance was at least as important a property as the complementary attribute conductivity.

So long as the circulation continues good, the rate of the ventricles remains at about normal value, but as the heart fails the ventricular rate rises proportionately. Meanwhile no change in the character or the frequency of the auricular movements occurs. This speeding up of the ventricles cannot be due to increased strength of the auricular stimuli allowing more of them to pass the junctional tissues. A direct action on the weakened ventricles is unlikely. It must therefore depend on some mechanism affecting the ventricular tissues, or on an *improved* conductivity. Vagal fatigue might be suggested as a possible explanation were it not that the atropine test usually shows a vagal activity *apparently* greater at these faster rates. Cushny¹⁸ compares the increase conduction seen in the healthy heart on exercise, where the acceleratory centre is excited as the inhibiting mechanism becomes less active, but suggests that this extrinsic nervous apparatus is not concerned in acceleration in disease, since the marked increase in rate which follows administration of

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atropine shows the inhibiting side to be as active as usual. This argument is not complete for it fails to take account of the sympathetic mechanism which shares in the Bainbridge reflex, and may still be in operation when the vagus is paralysed. Indeed the greater vagal release at this stage may be taken to indicate an increase in vagal tone to counterbalance an augmented activity of accelerator fibres during heart failure. Elsewhere¹⁹ Cushny suggests that in failure the ventricular muscle is more excitable and more ready to respond to stimuli, while as improvement occurs from rest in bed the excitability diminishes and the chamber now responds to fewer impulses. The mechanisms controlling the heart appear exceedingly complex. It would seem that the ventricles can react to the usual demands of life directly and independently of the auricles and the S.A.N., which are quite out of control during fibrillation. As the nervous mechanism to the A.V. node is intact, it is probable that existing reflexes make use of it.

There is no evidence that in auricular fibrillation the A.V. node is acting as an independent pacemaker, but the other factors known to influence the heart rate are acting through the A.V. tissues. The number of impulses reaching the ventricle (*i.e.* its rate) therefore probably indicates the existing conductivity of the junctional tissues.

The locus of digitalis action.—Clinically it has long been recognised that the response to digitalis varies greatly in different individuals, patients with fibrillation giving a more uniformly greater reaction than non-fibrillators in whom little improvement may result. This observation is borne out by our figures. The distinction between the two classes is so marked that fundamentally different mechanisms are probably involved in the two cases. The clinical observer, even with the use of the electro-cardiograph and other scientific methods, has few data on which to decide the question, and must seek aid from the pharmacologist. From observations on healthy mammals the laboratory worker shows that digitalis possesses two types of action on the heart, a direct or local effect on the tissues of various parts of the organ, and an indirect action through the cardio-inhibiting centre in the brain. The direct muscular action is greatest on the ventricles and is rather less powerful on the auricles, while the *healthy* conducting tissues are probably not influenced. This local effect of the drug consists in a raising of the muscular tone, an increase in the

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strength of the systole with a greater stroke output, and a more complete emptying of the chambers. The muscle also becomes more excitable and the diastolic relaxation is less complete under the direct action of digitalis. This type of action is said not to alter the rhythm, but if it resulted in a more vigorous circulation should theoretically give rise to compensatory reflex slowing of the heart rate.

In the mammalian heart the direct effects are largely overshadowed by the inhibitory action of the drug. Digitalis stimulates the cardio-inhibiting centre in the brain and messages sent by way of the vagus nerves influence each tissue in the heart, but principally the nodes and the bundle of His. Central or vagal action slows the rate of generation of impulses by the S.A.N., thus reducing the heart rate, allowing more time for diastolic filling and resulting in a more efficient systole. This more powerful contraction might in turn tend to further slow the heart. Besides their action on the S.A.N. the vagi influence the passage of impulses from auricle to ventricle by depressing conductivity at the A.V. node. Stimuli now take longer to pass and they may also suffer some reduction in strength—conduction with decrement. Cohn and Fraser,²⁰ who studied the effects of digitalis on normal individuals, emphasised the distinction between these two vagal actions. The effect of the vagi on the muscle walls is in the direction of weakening contraction, shortening the refractory period and increasing dilatation. This latter vagal action is greatest on the auricular musculature. It is directly opposed to the local action of the drug and is usually overshadowed by the latter. In the heart with normal rhythm impaired conduction between auricle and ventricle, though almost constantly present when therapeutic doses of digitalis have been given, *could not influence* either the rate of the heart or the power of its contraction. Where slowing occurs after digitalis in subjects with normal rhythm two explanations appear possible. Firstly there is the central inhibitory action on the generation of impulses by the S.A.N., and secondly, the direct strengthening action of the drug on the muscle of the ventricle might bring about a reflex slowing of the heart by producing a greater output. The heart rate is one of the constants of the body, and for each individual in health is maintained at approximately the same value under basal resting conditions, any tendency to depart from this being

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opposed by adjusting reflexes. Failure to find pulse slowing in certain of our cases might be accounted for in this way. Support seems to be lent to this view by the fact that depression of A.V. conduction may be present in patients in whom no slowing followed digitalis. Very variable and uncertain results are obtained from digitalis in non-fibrillating cases, although it is well recognised that considerable improvement in the circulation may occur without much change in the pulse rate. Where the heart is perfectly normal, slowing is probably effected by inhibition of stimulus production. Non-fibrillating cases of cardiac disease seldom show a pulse reduction as great as that in fibrillators, and as far as can be made out the degree of failure present appears to have little influence on the result. The faster initial rates show no greater effect than the others. Laboratory investigations have demonstrated that where the heart is healthy, digitalis by its inhibitory action tends to increase diastolic relaxation of the muscle, but where the walls are already weak and dilated the drug by local action reduces this relaxation. This may account for some of the variable results. Occasionally considerable slowing may be met with in non-fibrillators, as in a few cases with initial rates of 80 to 100 in Fig. 2.

Much more dramatic and profound changes are met with in cases of *auricular fibrillation*, and conditions appear to be entirely different. The S.A.N. is now no longer in control and inhibitory impulses to it will be of no avail. Theoretically in auricular fibrillation direct action of digitalis on the muscle of the ventricle is still possible, and by strengthening its contraction should lead to slowing. But as this method is also equally possible in decompensated non-fibrillators in whom the results of digitalis are so different, it would seem unlikely that this type of action could account for the very striking results in cases of fibrillation. The remarkable beneficial effect of digitalis in patients suffering from auricular fibrillation is usually attributed to the ability of the drug to affect the conducting mechanism. Much discussion has centred round this question. That digitalis can protect the ventricles by shutting off a greater proportion of the auricular impulses is usually conceded, but its exact mode of accomplishing this is still in doubt.

Lengthening of the A.V. (*p-r*) interval can readily be demonstrated in patients with normal rhythm after the giving

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of digitalis, and atropine *almost* entirely removes this impairment of conduction, proving it to be a central action operated through the vagi whose nerve endings are paralysed by the atropine. It would therefore appear justifiable to infer that a similar inhibitory process is present in cases of auricular fibrillation, since as we have seen the vagi are still in operation, ocular pressure or pressure over the vagus in the neck,²¹ resulting in temporary slowing of ventricular movements. Considerable doubt has been thrown on this question by the reaction of such cases to atropine, and this has led many to believe that the principal effect of digitalis is not a central one, but that in auricular fibrillation it must be directly on the conducting tissues.

Cushny,²² on the basis of his investigations, concluded that stimulation of the vagus with consequent impairment of conduction could not explain the action of digitalis. He pointed out that a dose of atropine given before digitalis produced a greater acceleration of the pulse than occurred when the same amount of atropine was given to the fully digitalised subject. Lewis,²³ discussing these results, agrees with that statement and postulates that for *complete* proof that digitalis action is entirely vagal, the pulse release (acceleration) under atropine should not only neutralise the slowing caused by digitalis, but should reach the same figure as the maximum acceleration previously caused by atropine (Fig. 4, No. 1). And for *complete* proof of the opposite contention that digitalis slowing is entirely a muscular effect, it is necessary that atropine should cause no acceleration at all when the heart is under digitalis (No. 2). Neither of these conditions is fulfilled in actual clinical observations, for while some release invariably occurs after the second dose of atropine, it never reaches as high a level as the acceleration caused by the first dose (Nos. 3, 4 or 5). In Cushny's series, with one exception, the atropine release did not even neutralise the digitalis slowing. Lewis criticised the smallness of the dose used (atropine sulphate gr. 1/50) as being inadequate to produce complete paralysis of the vagal nerve endings, and in his own cases employed doses totaling gr. 1/20. His results appear to be quite different from those of Cushny. The acceleration after atropine is much greater both before and after digitalis slowing, and in several examples illustrated in his article the effect of the digitalis has been neutralised. In none, however, does the

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maximum value of the second acceleration reach the same point as the first. The nearest is his case 5, where the release in the two tests is practically the same (131 and 135), but the maximum values 232 and 205 differ by a figure (27) which closely corresponds to the digitalis slowing (31). This experiment by itself would suggest that the same amount of vagal tone existed in both cases, but the digitalis slowing depended on some other mechanism. His other cases show little uniformity. Large amounts of atropine produce rather pro-

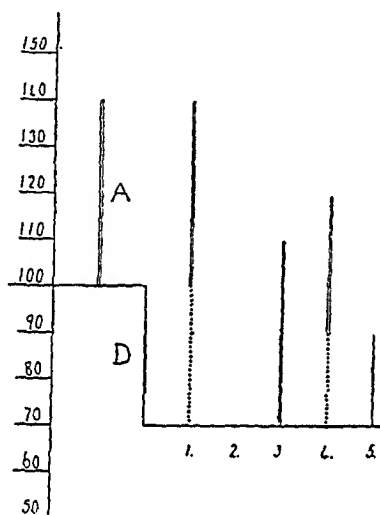


FIG. 4.—Diagram after Lewis to compare effects of atropine and digitalis. A=atropine release before digitalisation; D=slowing under digitalis. Double lines indicate original vagus tone. Case 1 illustrates requirement by Lewis for complete proof that digitalis action is entirely vagal, and 2 that it is not all vagal. No. 3 vagus effect equal before and after digitalisation as suggested by his case 5. Experimental results are inconclusive (Nos. 4 and 5).

found general symptoms and considerable discomfort which almost certainly must secondarily disturb the circulation. The results of Lewis are therefore not above suspicion. Smaller doses avoiding these pitfalls should give proportionate effects and so indicate the true state of affairs. Cushny's results show greater agreement in type. A re-examination of the data from his paper is illuminating. Figures are given for nine patients suffering from auricular fibrillation. Digitalis was administered to them at the rate of one drachm daily until a complete therapeutic dose had been given, as indicated by the first signs of intoxication. The amount of slowing plotted against initial

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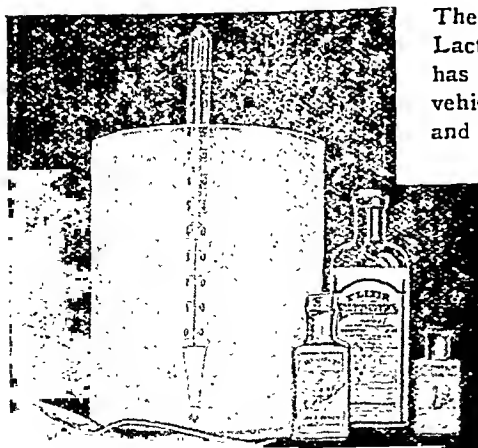
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pulse rate showed a very high degree of correlation ($r = 0.93$), and the actual points are seen to lie very close to the best value line $m-m$ (Fig. 3). As in our cases, this line crosses the base about 40 (actually at 44). When the atropine figures are similarly examined an interesting fact is revealed (Fig. 5). There are two atropine observations for each patient, the larger effect being obtained when the pulse rate was high before

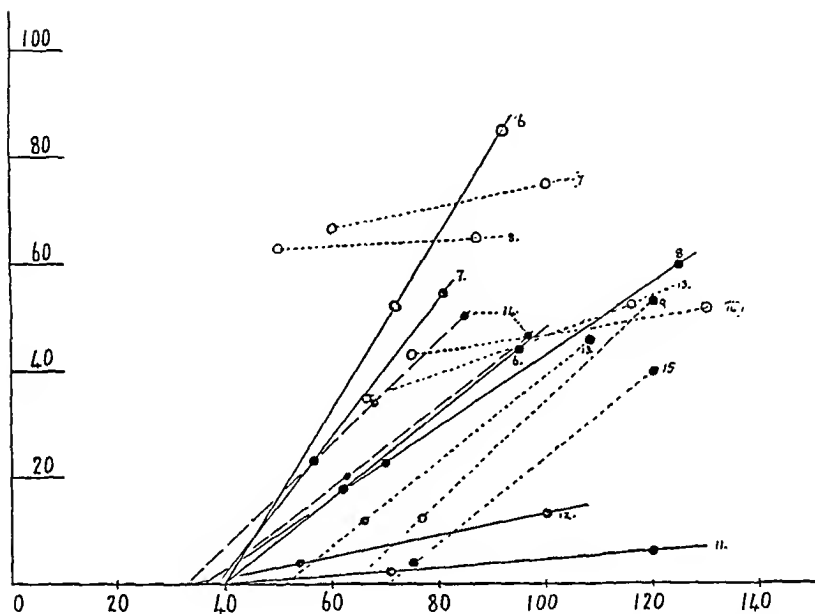


FIG. 5.—Effects of atropine before and after digitalisation. Abscissa=initial pulse rate, ordinates=pulse acceleration. Higher figures before, lower readings after. Cases from Cushny's series shown thus ●, those from Lewis' paper thus O, the accompanying figures being the respective case numbers. Notice the general tendency to converge about 40 on the base line.

digitalis, and the smaller acceleration occurring when the heart had slowed under that drug. Cases 9 and 15 may be omitted since in them digitalisation produced coupled rhythm, the extra-systoles of which would be outside vagal control. If lines are drawn joining the pairs of observed points from the other subjects and these are prolonged, they will be found in most instances to cross the base line at *about* 40. Even cases 11 and 12, who showed very little reaction at all, either before or after digitalis, appear to conform to the general rule. One

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of Lewis' patients (No. 6) gives a reaction of this type also. Surely this remarkable uniformity must be more than a mere coincidence! That the lines cut the base about 40 (the value of the idioventricular rate when complete block is present) recalls the reaction to digitalis (Figs. 1, 2 and 3). If it be accepted that the heart rate in auricular fibrillation is a measure of the existing conductivity of the A.V. tissues, the form of the graphs given by standard doses of these two drugs indicates that they both affect conduction. Further, both drugs agree in producing a greater effect when the pulse is already fast and the A.V. tissues are more conductive (as also does exercise in such subjects), and in acting with greater difficulty as the pulse rate slows and the resistance is increased. The results of similar doses of digitalis are wonderfully uniform, not only from different initial pulse rates in the same individual, but also from one subject to another. Such agreement with the common law suggest that the result depends on the strength of the drug and the degree of conductivity present, and not on any individual peculiarity. In the case of atropine, on the other hand, while a fair degree of uniformity exists amongst the results in an individual (*e.g.* Cushny's case 14), the degree of response in separate subjects is vastly different. Some react readily both before and after digitalisation (cases 6 and 7, Fig. 5), while others (11 and 12) give scarcely any release on either occasion. The different slopes of the lines in Fig. 5 probably represent various degrees of vagal activity. It is well known that the tone of the vagi, and therefore the response to atropine changes at different ages, being minimal in infancy, increasing to a maximum between 25 and 35 and declining to a low level in old age.²⁴ Case 11 was 62 years old and suffered from interstitial myocarditis, while number 12 was also past middle life. These dissimilarities might, of course, be attributable to varying susceptibility of the vagus nerve endings to atropine, permitting consequently different degrees of paralysis, rather than to variations in the amount of vagal inhibition actually present. It is difficult to reconcile these different responses to the two drugs with the view that digitalis acts solely through the vagus. Again it may be recalled that though both digitalis and vagal stimulation produce impairment of A.V. conduction, they act on the heart *muscle* in opposite directions, the drug strengthening contraction while the nerve causes weakening.

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We have already seen that the complementary states of resistance and conductivity in the A.V. node depend on at least two components. Firstly, refractoriness of the junctional tissues accounts for the disappearance of all impulses in excess of 250 to 270. Additional resistance reduces the number to somewhere between 160 and 80, and under digitalis to a still lower value. This extra obstruction may be entirely vagal, or may be partly vagal and partly a property of the tissues. Sufficiently large doses of atropine ought to wipe out the vagal portion entirely, and smaller quantities should give proportionate effects. But since even enormous doses of atropine fail to let through 270 impulses, some other influence must be present. The fact that atropine as well as digitalis appears to exert less and less influence at lower initial pulse rates supports this view. The lesser release after digitalisation is only apparent. Actually the vagal component remains relatively constant at different pulse rates, the atropine release on each occasion being a definite proportion of the existing conductivity (say 2 per cent. or 30 per cent.). The principal controlling factor would therefore seem to be the existing state of the tissue itself. On what this depends is not apparent, but it bears a relation to the speed of the ventricles and to the strength of their contractions.

The vagus nerves possess an anabolic action on the heart,²⁵ and it is possible that digitalis by increasing vagal activity might produce a permanent change in the tissues. That digitalis action is not entirely vagal appears to be evident, but it is not possible to prove that none of the impaired conductivity is due to an action of the drug on the vagal centres. But if the digitalis effect were largely a central one, a much greater release would be expected on the second test with atropine, and the lines joining the two observed points would cross the abscissa to the left of 40 or even beyond zero. The question remains unsettled, but the balance of evidence supports Cushny's contention that digitalis acts at least partly in some direct fashion on the conducting tissues.

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PERISCOPE

BLADDER SYMPTOMS FROM CONGENITAL DEFORMITIES WITH ASSOCIATED NERVE LESIONS.

Three cases are described presenting urological symptoms due to congenital deformities with associated nerve lesions.

The first case was that of a man of 37 years of age, who had no urinary symptoms till he was 24 years, when he developed difficulty in micturition. The symptoms became progressively worse, and patient had to use the catheter frequently. There was some bowel difficulty—constipation and faulty sphincter control, which was getting progressively worse. Radiograph showed a spina bifida occulta of the upper part of the sacrum. It was through that the sacral root fibres at the level of the 1st sacral vertebræ were mechanically affected by a slowly progressing lesion. There were slight changes in the leg reflexes, and a small area of diminished sensation over the sacrum. An operation was carried out, and the defect in the sacrum was exposed by removing the spinous process of 5th lumbar vertebræ. A mass of fat investing a swollen sac of dura was revealed. The lower fibres of the cauda equina were adherent to the fatty mass and were dissected free. The mass of fat was removed, and the wound closed. Patient was catheterised at regular intervals for four weeks, when he began to void naturally and has continued to do so.

The second case was a girl of 25 years, with a history of chronic invalidism since birth. She had had an amputation through the left thigh and a partial amputation of the right foot, for extensive ulcerations involving the bones. She always had had urgent urination and difficulty of controlling both the sphincters of bladder and bowel. She was admitted to hospital with a distended bladder containing 500 c.c. of infected urine. Bilateral pyelitis was present. Radiograph showed spina bifida occulta with absence of arches of 4th and 5th lumbar vertebræ. Cystoscopy revealed a trabeculated and infected bladder. Symptoms had always been present, but became much aggravated by addition of infection.

The third case was a male student of 17 years, who had been born with an imperforate anus, which had been successfully treated. Cystoscopy revealed a slight congenital deformity of the posterior urethra, and the presence of a unilateral fused kidney on the left side. Radiograph showed the presence of six lumbar vertebræ, and no coccyx present, the sacrum terminating in an irregular mass of bone. Attacks of pyelitis frequently followed respiratory infections, and weakness of sphincter control of bowel had always been present.

The first case was the only one in which operative treatment was carried out.

Periscope

[The successful result obtained in the first case emphasises the value operative treatment may have in a few select cases. The cases most likely to furnish good results are those where the onset of symptoms has been late.]

F. H. COLBY, Boston (*The Boston Medical and Surgical Journal*,
November 1926). A. J. C. H.

VOLVULUS OF SIGMOID FLEXURE.

Twelve cases of volvulus of the sigmoid flexure, acute and chronic, are studied. Three types are recognised: (1) The acute type with sharp attacks, (2) the recurrent type with short sharp attacks continuously recurring, and (3) the chronic type with atypical moderate attacks of abdominal pain, often of daily occurrence.

In children with congenital megasigmoidium the author believes that depending on the degree of stasis and subsequent obstruction, either Hirschsprung's disease or chronic volvulus may develop. In stasis cases chronic mesosigmoiditis with fibrosis causes shrinking of the base of the mesosigmoid, which tends to volvulus or double-barrelled flexure formation. In diagnosis the barium enema is the most satisfactory means. In treatment removal of the flexure is advocated and the technique is described in detail.

B. FERNSTROIM, "Volvulus of the Colon and its Treatment,"
(*Acta Chirurgica Scandinavica*, lxi. (ii.-iii.) 213).

D. B.

PARAPLEGIA IN CHONDRODYSPLASIA.

A male achondroplastic, aged 46, developed at the age of 40 trouble with his sphincters. There then occurred an incomplete spasmodic paraplegia with hyperæsthesia and spinal reflexes. Lumbar puncture was negative and radiography showed nothing abnormal. The lesion, however, was located at the 12th thoracic segment, and laminectomy from 9th to 12th thoracic was carried out with a little difficulty on account of the thickness of the laminæ. At the level of the 12th thoracic there was a distinct diminution of the dural sacs with meningeal adhesions and an encysted serous meningitis. A slow and gradual amelioration followed the operation, and three years later he was able to walk a little, and the trouble with his sphincters had disappeared as had his sensory phenomena. The author suggests that compression of the cord was the result of narrowing due to premature ossification of the vertebræ and the intervertebral discs. Besides this one might have an osteophytic spondylitis which would increase or cause pressure on the cord.

O. ALBRECHT and E. RANZI, "Kompressionsmyelitis bei Chondrodystrophie" (*Wiener klin. Wochenschr.*, 1926, xxxix., 1241).

Periscope

EXOPHTHALMIC GOITRE, A SEQUEL TO RADIOTHERAPY.

Ujma reports a case in which he believes typical exophthalmic goitre followed a single exposure of the ovarian region to the influence of radium. It concerned a young woman who had menstruated regularly and normally since the age of 13 years. Besides nervousness she had developed a metrorrhagia for which she was curetted and some polypoid debris removed whose non-malignancy was confirmed by histological examination. No improvement of the metrorrhagia ensued, and after some months of expectant treatment a single application of radium was given. Immediately thereafter she felt sick and vomited, and a few days later developed giddiness, a feeling of suffocation and sharp pains in the trachea. Two months later there was tachycardia with rapid pulse, tremulousness, insomnia, loss of flesh and more or less abundant perspirations. The thyroid was distinctly fuller and there was slight swelling of the eyelids with the usual ocular signs of exophthalmic goitre.

The functional interrelations of the ovary and the thyroid are well known as noted in young girls at puberty, in pregnant women, and at the menopause. Exophthalmic goitre has been observed to accompany genital hypoplasia and to follow oöphorectomy (Bandler and Bardachzi), and the author claims that the cessation of the metrorrhagia initiated a radium-produced ovarian destruction and recommends surgical interference rather than radiotherapy.

A. UJMA, "Basedow nach Röntgenkastration" (*Zentralbl. f. Gynäkol.*, Leipzig, 1927, li., 610). D. M. G.

IDENTICAL TWINS.

The occurrence of psychoses or other abnormal mental conditions in twins is of interest, as it affords an opportunity for the comparative study of mental constitution and mental mechanisms.

Two female identical twins, now aged 43 years, are described. Their life experiences began to differ almost immediately after birth, one being breast-fed and the other bottle-fed. They grew up together and the one married at 19 years and the other at 21. Their lives then separated. Both were shallow, poorly integrated personalities, intellectually not of a high order, and their emotional development was childish. Although after their majority both accumulated different life experiences, both later became hypochondriacal and mildly delusional, and even in the fifth decade of life showed remarkable similarity in their physical and mental characteristics. The nature of their psychoses was largely compensatory of the simple wish-fulfilling type. Their psychical make-up was thus also very similar.

WINIFRED RICHMOND, "The Psychic Resemblances in Identical Twins" (*Amer. Journ. Psychiat.*, 1926, vi., 161-174).

N. B.

OBITUARY.

HARVEY LITTLEJOHN, M.A., M.B., B.Sc., F.R.C.S.E.

Born October 1862—Died August 1927.

My friendship with Harvey Littlejohn commenced nearly forty years ago in circumstances which were particularly helpful to me. He was Senior President of the Royal Medical Society and I was Senior Secretary. We saw a great deal of each other. It was both a privilege and an education to me, as an undergraduate, to be associated with him in this relationship. His strong sense of duty, conduct of business, breadth of view and sound judgment, even at this early stage of his career, were much in evidence. He displayed a genuine interest in the work of the Society and sought in many ways to promote its welfare.

At this period (1888-89) his days were fully occupied. He was reading for the Science Degree in Public Health and for the Licence of the Royal College of Surgeons of Edinburgh, preparatory to sitting for the Fellowship examination. He assisted his father, Sir Henry, in the Department of the Medical Officer of Health and in the Class of Medical Jurisprudence conducted by him at Surgeons' Hall. In 1891, however, Harvey Littlejohn was appointed Medical Officer of Health to the City of Sheffield, and, during the next six years, his friends in Edinburgh saw comparatively little of him save during brief visits to the paternal home. When, in 1897, on the resignation of Sir Douglas MacLagan, public health and forensic medicine were no longer taught conjointly, Sir Henry Littlejohn was called to the Chair of Medical Jurisprudence in the University, and Harvey, having resigned his appointment in Sheffield, qualified as Lecturer on the same subject at Surgeons' Hall. Amongst his colleagues were D. Noël Paton, Ryland Whitaker, Alexander Bruce, George Mackay, and James W. B. Hodsdon.

From this time until his death, covering a period of thirty years, he was closely identified with the life of the Edinburgh Medical School, of which he became a very prominent member; for nine years as a teacher in the Extra-Mural School and for twenty-one as Professor in the University in succession to his father. His energies were not directed entirely to the purely professional side of his work. As an old Rugby Football player, a member of one of "Charlie Reid's" famous Academical teams in the eighties, he was a strong supporter of the University Athletic Club; he became Commandant of the Medical Unit of the Officers' Training Corps, and on the outbreak of the War he took an important part in its reorganisation.



Photo by]

HARVEY LITTLEJOHN

[Elliott & Fry, Ltd.

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For several years he interested himself and stimulated the interest of the younger Fellows in the work of the Royal College of Surgeons, but with his succession to the Chair of Medical Jurisprudence in 1906, he became more intimately associated with University affairs. The special qualifications to which reference has already been made, marked him out as eminently fitted to assume administrative responsibilities. He was appointed Dean of the Medical Faculty, an office which he filled with conspicuous success; one of the members of the Senatus on the University Court and on the General Medical Council; and on more than one occasion he represented the University on the Board of Management of the Royal Infirmary. In all three positions his opinion carried great weight.

As a lecturer, Harvey Littlejohn captivated his audience and held their close attention from first to last. He impressed them by his knowledge, by his power of dramatic exposition and by the liberal display of illustration in the series of graphic word-pictures with which he demonstrated his points and drove home the important facts he desired his students to remember.

His contributions to medical literature were not numerous. He was not a prolific writer. His Annual Reports as Medical Officer of Health for Sheffield bear evidence of his clear and concise method of expression. He contributed more than one paper to this *Journal*, notably an illustrated description of the appearances presented in the drowned, and, in the *Encyclopedia Medica*, the article on Medical Jurisprudence was from his pen. In 1925 he published an Atlas, profusely illustrated with photographs of the material contained in his museum. To the compilation of this book he devoted much time and care in association with his assistant, Dr Douglas Kerr. For many years the Littlejohns, father and son, held the office of Police Surgeon to the city. During this period they brought together a wealth of material bearing upon their subject which enabled them to form a museum second to none in this country and, outside Paris and Vienna, probably containing the finest collection of the kind in Europe. Harvey Littlejohn has very appropriately bequeathed the museum to his *Alma Mater*, in whose keeping it will remain as a permanent memorial of the Littlejohns' scientific contribution to forensic medicine; *si monumentum requæris, circumspice*.

In his position as adviser to the Crown in criminal proceedings, Harvey frequently acted as a special witness. On this aspect of his work others are more competent to write than I. In the preparation of the material on which his evidence was based he exercised the greatest care, and in the witness-box he stated, concisely and clearly, his facts and deductions.

He possessed many qualities which endeared him to a large circle of friends, and which enhanced the pleasure of intercourse with him.

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A fund of humour and ready wit, capability as a story-teller and a facile gift of repartee, all contributed to the enjoyment of his society. His "mental agility," however, sometimes made it difficult for him to appreciate the fact that all were not so quick-witted as himself, rendering him somewhat impatient with those unable at once to grasp his point. A great traveller, an accomplished linguist, an omnivorous reader, with an intuitive insight into men and affairs, and with a selective taste for old prints and furniture, conversation with him could not fail to be interesting and profitable. In a quiet and unobtrusive way, also, he rendered material assistance to many, and was always willing to give considered advice to those seeking his help.

The ill-health from which he suffered towards the end of his life caused him to withdraw to a great extent from social functions. In the old-time gatherings of colleagues and friends we missed the old Littlejohn; the genial banter, the infectious laugh and humorous sallies, formerly so pleasing a feature of these reunions, no longer brightened the proceedings. To the last, work continued to be the first consideration with him, and anything that tended to overtax his physical powers had perforce to be discontinued. Life bereft of the capability of pursuing his vocation made no appeal to him, and during his closing days he more than once gave expression to this point of view.

Perchance the future historian of the Edinburgh Medical School may seek to draw a parallel between the achievements of the Littlejohns in public and academic spheres, and in the status which they gave to the Chair of Medical Jurisprudence, and the activities of the Monros, *primus* and *secundus*, in their generation, both in the life of the City and University and in the Chair of Anatomy.

A. L. T.

I remember the time, in 1891, when Harvey Littlejohn was appointed Medical Officer of Health at Sheffield. It was a matter of discussion at Edinburgh whether he was doing wisely to leave the job of assisting his father. I have little doubt he was right, though his time at Sheffield did not entirely meet his disposition or hopes. After several years he returned to become a lecturer in the Extra-Mural School, and from that position he was appointed, on the resignation of his father, Sir Henry Littlejohn, to the Professorship of Forensic Medicine and the Police Surgeonship. That was in 1906. So he had a full twenty years, rich in growing experience and richer still in public service. The joint service of father and son followed the tradition of the Monros. Sir Henry taught Forensic Medicine for fifty years (1856-1906), and the son was professor for twenty-one more.

I knew him pretty well and we were great friends. On my visits

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to Edinburgh he would never allow me, when he was at home, to stay elsewhere than under his roof. When in London we would dine together, or he would come to teach us a thing or two in Whitehall. Yet my brief notes cannot be other than fragmentary. One of the things that always struck me about him as a medical man was his ambition to be master of his job, and this in an exceptional degree he became. We used to agree that "good enough is never good." He was, of course, not always right, nor did he always get the correct hang of a thing, but he was always for a policy and a practice which was *thorough*. His poor health was a terrible handicap—a victim of asthma and bronchial catarrh—but he fought it courageously, and it did not dismay him. He became one of the greatest teachers in the University, and a conscientious and highly competent police surgeon to the City. Being the son of his father gave him a preferential start, but it was his own inherent capacity that carried him to the top. There were three characteristics which, I think, explained his success, in spite of the odds against him. First, he acquired knowledge and experience—arts, medicine, science, surgery, obstetrics—at home and abroad; teaching practice, the work of a medical officer of health, the duties and opportunities of a Dean of the Faculty, a true love of learning and culture, and a strange and varied observation of men and affairs. He liked to be, what he was, a man of the world in the best sense, happy to meet and co-operate with all sorts and conditions of men. He was at home in any company, comfortable in unfamiliar situations, cosmopolitan in taste. All this came by an experience, sought and laboured for, which he stored up and reflected upon. Then, his intellect, though not exceptionally great, was unusually acute and penetrating, well furnished with imaginative and intuitive faculties. This I think was hereditary, but he did not permit it to degenerate or atrophy as inherited mental powers are apt to do. He exercised his mind in diverse spheres, and vastly enjoyed doing so. It had but few conventions, and could hold or part with its prejudices and predilections with ease, which is I suppose one of the sources of humour and native wit.

A third characteristic was a remarkable gift of exposition. He could explain anything, not its abstruseness, for he was not esoteric, but its simplicity, for he was single-minded. He would pretend to be superior and supercilious, cultivating a nonchalant air and an unconcerned visage, then quick as lightning he would press his interpretation with a warmth and conviction which were at least plausible, and often irresistible and winning. There was logic, reason, intellectual grasp, and there was an appealing and persuasive claim for assent. Yes, somehow or other, he knew the hearts of men. This faculty disciplined makes an educator as well as an advocate, and an educator most certainly he became. He educated by pictures, cameos, analogies,

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the graphic method. Forensic Medicine was better taught by Littlejohn than by anyone else in Britain. Consider that living, gruesome, dramatic museum which he gathered together in his department—it was a revelation of the false allurements and frailties of mankind and of the application of scientific method to their exploration, a tremendous factor in education. The primary business of a University teacher is to awaken and arrest his pupil, to unveil truth and interpret it, to present analysis and synthesis with such data, sequence and style that the mind is captivated and then transformed. Littlejohn could do all that, when he chose, and when his health permitted him. For he had a positive genius for teaching. Consider, too, that black book of his on *Forensic Medicine*, which he published in 1925, an illustrated record of post-mortem conditions, and the signs of death by drowning, hanging, choking, fire-arms, burning, cut-throat, wounds, infanticide; consider his lectures at their best; remember how often in Edinburgh and at the General Medical Council or the Medico-Legal Society in London he could change the direction of men's minds; recall the times through a generation when law courts awaited his word; laugh again and once more at his irresistible and audacious stories, true and fictional, and you cannot doubt that Littlejohn was gifted beyond other men with a wonderful power of exposition and interpretation. What Edmund Burke said of a friend was true of Littlejohn: "His understanding was comprehensive, steady, vigorous, made for the practical business of the State." So, long ago, I learned to admire this master craftsman, with his varied experience of life, his bright and orderly mind, and his refreshing way of expressing it. We could well do with some more teachers like him.

Littlejohn was also a good citizen—public-spirited, dutiful, a consistent supporter of the Commonwealth. "Mine own ancient city" seemed to belong to him. He ought to have lived at Madeira or the Cape, but he would not leave Edinburgh. He loved it with all his heart, but when you accused him of this affection he would haughtily assure you the idea was preposterous. Of course, Edinburgh was *facile princeps* in all things, but there was no call for sentiment about the matter. In later years he made no further attempt to conceal it from me. And then the fun began. "To-day we will go to Greyfriars." "To-morrow we will do the Canongate or the cells"—then Abbotsford, or Scott's Edinburgh homes, or the Parliament House, or the old bookshops and the wynds. Those gloomy old tombs seemed to bring forth their forgotten but illustrious dead—warm, living, romantic—those old books their secret, those ancient houses their habitants. His historical sense and his love of books made him a discerning companion. We would spend an hour in a bookshop, he engaged in a steady cross-fire of raillery with the proprietor; or he would carry on an argument with the custodian of Greyfriars; or

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converse with the denizens of High Street or the unlucky criminals in the cells, upbraiding, reproofing, encouraging, admonishing. "You are a foolish old man," he said one Sunday morning to an imprisoned patriarch who had been indiscreet on Saturday night, "and you ought to be thoroughly ashamed of yourself." I pleaded subsequently for the patriarch caught in an unpleasant dilemma, and Pharaoh's heart became less hard. "Well, well, I will do my best for him, and I daresay my words will be his only punishment." I think I never knew anyone who could conceal so much kindness of heart and deed more completely than Littlejohn. "His benevolence was conveyed by secret veins, and when it arose to view it occasioned a blush upon his cheek." He was the embodiment of generosity, goodness, and tenderness, yet he would, on occasion, elaborately clothe himself with the apparel of austerity, and solemnly enjoy the deception. He dwelt often in the past, and by imagination lived in it—the old houses and streets of Edinburgh, the Scottish Judges of a former day, the medical Edinburgh of the eighteenth century, the city and surroundings of his own early days, the giants who made the Medical School, the poets and writers of Scotland, and above all Walter Scott, the immortal, the one and only, "the Great Unknown." Who wrote *Paul's Letters*? Who was Dr Peter Morris? Why is *The Antiquary* the best of the novels and *Marmion* of the poems? What was Scott's great error of judgment? Should a study of Scott be made compulsory upon every Edinburgh medical student? Why is Lockhart's *Life of Scott* so much finer a biography than Boswell's *Johnson*? Ah, and what about Miss Margaret Stuart Belches of Invermay, the lady of the green mantle? These were the really important matters in romantic evenings at Rutland Street. Such subjects had two rivals—the current state of the Edinburgh Medical School and the British public health service. Whither? for both of them, whither?

He would solemnly recount the services and personality of the great professors of the past illustrating by old books and portraits, the success of Edinburgh graduates in practical life, the historical value of the Extra-Mural School, the renown and tradition of the two Colleges. He loved to dwell upon the period in the eighteenth century when Edinburgh stood alone and the Medical Schools of London and the New World followed her leadership. He would stand on the staircase and discourse upon his wonderful collection of old Edinburgh prints on its walls. Here was an imperial and impregnable city, a stronghold and fortress which had burst its bounds, the home of great thinkers and mighty doers, a shadow from the heat and a shelter from the storm. Having listened, I would interpolate suggestions. "But consider the glories of Kelvingrove and the landscape of the Tyne; and reflect upon the magnificent

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recent medical progress of Glasgow and the clinical work at Newcastle." Then he would turn with a long and anxious face and outspread hands, "Hoots, man, hoots; it was all born *here*," but he went away sorrowful, silently wagging his head as if the end of the world were imminent. He was splendidly jealous, never satisfied except with the best, suspect and hypercritical of untoward circumstance or of distinguished men who did not fulfil their glittering promise, a zealous and faithful admirer of heroes not a few, and a deep, steady and persistent lover of his University. Then he was a sound public health merchant, seeking goodly pearls. The organisation and guidance of State Medicine must be directed with wisdom, with philosophy, with a wide and forward outlook. The Public Health Acts must be simplified and consolidated; the sanitation of his father's day was a good foundation but the time for superstructure had come; the public health system must be widened to make room for the services of practitioners; every student and every doctor must be a Preventive Medicine man. Maternity, child-welfare, health insurance, "imperial medicine," immunology—they must all be integrated; hospitals and medical schools must be reformed to turn out a new type of man. Yet the good things of the past must be kept. The medical student must *dress* tidily, he must be *cultured*, he must be *diligent*, he must be a *gentleman*. "No trade-union tricks for me," he would say, with a shrug of the shoulders and an inimitable gesture of excellence—all of it endorsed so aptly by his own natural smartness and urbanity, by his accomplishments, by his innate dislike of slovenliness, and by his courtesy.

Harvey Littlejohn was a good man and a master-workman. He was not always easy, not addicted to conventionality, sometimes perverse or inclined to mischief; but a big-hearted man, a courageous and dauntless personage, battling with physical disability, with a scroll of high thought and purpose concealed within. He had disappointments, yet he overcame them and was not embittered; he was a bachelor, yet enjoyed the affection and regard of women; he was witty, a dramatic raconteur, vivacious, energetic, but at root kindly, gentle, and sympathetic; he was a medical man, yet he had the sense of justice and responsibility of a Judge; he was a Professor, but human, sociable, mirth-creating; he excelled, yet was not conceited; he was democrat in sympathy and aristocrat in perception; he was both proud and humble. Gay, affable, whimsical, honourable, a man among a thousand, given to hospitality, one who had known great men, a delightful companion, a dear friend. When, far away, I learned he was dead a light seemed to go out and the joy of the world was less.

G. N.

NEW BOOKS

The Surgical Treatment of Thoracic Disease. By HOWARD LILIENTHAL, M.D., F.A.C.S. Two volumes. Pp. 1294, with 904 illustrations. London and Philadelphia: W. B. Saunders Company, Ltd. Price 90s.

If evidence were required of the progress of modern surgery it is afforded by such a work as this. Thirty years ago the surgery of the chest, excluding orthopædic surgery, occupied a comparatively small part of the general surgery text-book—to-day it is represented by two octavo volumes of 1300 pages. This is a publication of great value and importance, and it rivals Sauerbruch's *Chirurgie der Brüst-organie* in its size, detail, and completeness. The general plan of the book is well arranged, the physiology and anatomy of the chest and its viscera are fully elaborated, and with this knowledge the reader is introduced to the detailed study of diseases and injuries. Certain chapters are written by special contributors; the section on physiology, for example, has been committed to the able hands of Professor Ewart Graham—and by this arrangement there is no doubt that the general standard of the book has benefited.

Criticisms, of course, there are. We have been disappointed with the section on the œsophagus. It occupies an extent of some ninety pages, but, when all is said and done, the actual information given is amazingly small. This has arisen from the fact that so much space has been devoted to the description of operative procedures which are frankly not justifiable, such as, for example, the treatment of congenital tracheo-œsophageal fistula. It would probably have been sounder authorship to dismiss such a *lusus naturæ* with no more than a comment, and give further consideration to the commoner derangements. This want of balance is evident throughout the book.

The volumes are beautifully illustrated and they form a notable contribution to the many problems of thoracic surgery.

Practical Gastroscoy. By JEAN RACHET, M.D. Translated from French by F. F. Imianitoff. Pp. xi+148, with 60 illustrations. London: Baillière, Tindall & Cox. 1927. Price 15s net.

The striking results achieved by the methods of cystoscopy and sigmoidoscopy in permitting of early diagnosis and treatment have led many investigators to endeavour to obtain for gastric diagnosis the methods of precision now available for the bladder and lower bowel. The technical difficulties are considerable. Whatever the class of instrument used—and many gastroscopes have been introduced—the discomfort accompanying its passage on the conscious patient is a real handicap and the data obtained by its use are not always conclusive. The author gives an interesting history of the evolution of the method

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and a very fair and balanced review of its advantages and limitations. There can be no question that the accuracy of modern X-ray diagnosis of gastro-duodenal lesions has lessened the zeal of those who were striving to perfect a method of visual diagnosis of gastric diseases. That useful information may be obtained in a doubtful stomach lesion by the expert gastroscopist is abundantly proved by the author. That the method will ever come into general use even such an enthusiast as Rachet does not venture to predict. The book is well illustrated and is translated into idiomatic English.

The Psycho-Pathology of Tuberculosis. By D. G. MACLEOD MUNRO, M.D., C.M., M.R.C.P. Pp. viii + 92. Oxford University Press. Price 5s.

Whether there is, or is not, a definite specific phthisical psychoneurosis or psychosis, there can be no doubt of the desirability of treatment when it is found to be present. Some authorities hold that the mental and moral changes which have been noted are merely individual traits of temperament and conduct which exist quite apart from the disease, and are at most intensified or exaggerated by a debilitating illness. Others hold that they are toxæmic in origin. Excellent examples of these psycho-pathological states are given in *La Dame aux Camellias* by Dumas the younger, and *Eleanor* by Mrs Humphrey Ward, as well as in various autobiographies. The subject is discussed here under the headings of the psychoneuroses of latent or incipient tuberculosis, of the middle stage of pulmonary tuberculosis, of advanced tuberculosis, the psychoses of tuberculosis, phthisical insanity, psychotherapy in the treatment of tuberculosis, and tuberculosis and genius as shown in John Keats, Aubrey Beardsley, Thomas Hood, John Addington Symonds, and R. L. Stevenson.

Shell Shock and its Aftermath. By NORMAN FENTON, Ph.D., Ohio University. Pp. 173, illustrated. London: Henry Kimpton. 1926. Price 12s. 6d.

Many books on "shell shock" have been published expressing many different views, but here we have a special contribution which is singularly valuable, namely a study of the after results of treatment carefully followed up in 3000 cases, all of whom served in France in the American Expeditionary Force. Dr Fenton has found that all the agencies of medicine and humanitarianism during peace have been unable to do more to help such cases than did the overworked personnel of an Army Hospital during the War. He has shown the seriousness of any severe psychoneurotic manifestation and the persistence of a tendency to react unfavourably to adverse conditions, even when the symptoms of the original neurosis have been successfully dealt with. On the other hand, he has also shown a definite relationship

between make-up, personal resources, access to treatment, and complete rehabilitation that confirms a growing belief in the usefulness of adequate therapy and prophylaxis in psychopathic disorders. He has no sympathy with the remark that the Armistice may be regarded as the greatest psychotherapeutic incident in history. Neuroses tend to become part of the habit-system of the individual. The best adjustments were found in men in clerical, professional, and trade activities; those who had been in agriculture, mining, and transportation work made the poorest readaptation. Much useful information and criticism is included. The scientific value of this study is itself sufficient to make it one of the most important of recent contributions on the subject.

Epilepsy. A Functional Mental Illness: Its Treatment. By R. G. ROWS and W. E. BOND. Pp. vii+138. London: H. K. Lewis & Co., Ltd. 1926. Price 8s.

At the time of the lamented death of Dr Rows, this paper was only completed "in the rough," and Dr Bond states he has not felt justified in doing more than preparing the MS. for the publishers. The attitude of the authors is indicated in the title. Their views are based largely on experience acquired while treating psychoneuroses in a Ministry of Pensions Hospital, and they regard epilepsy purely from the point of view of a functional mental disorder amenable to treatment by psychotherapeutic methods. These are divided into the three stages of explanation, exploration, and re-education. That convulsive attacks, with or without unconsciousness, may result from purely psychic causes is established, and such are of course in need of psychic treatment. But all such cases are not epileptic, neither does such an explanation cover the whole field of epilepsy. Epilepsy, or rather the epilepsies, is a symbol under which are grouped a great variety of conditions which have the common characteristic of attacks of unconsciousness accompanied by a convulsion, but such other causal factors are mostly ignored here. With these limitations and as a study of this particular group of seizures much may be learned from this book.

Brain and Heart. Lectures on Physiology. By GIULIO FANO (of Rome), translated by Helen Ingleby, with a foreword by Prof. Starling. Pp. xv+142. London: Oxford University Press. Price 8s. 6d.

This small volume contains six lectures delivered by invitation to students in the Universities of Barcelona and Madrid. It is not simply a monograph dealing with the physiology of the brain and heart, but is rather a general survey of the thoughts and conclusions of a prominent physiologist looking backward on the theories and views he had formed and matured during a long scientific career. It thus takes on much of the character of an autobiography, and the brain and heart are merely

Notes on Books

used because they happen to lend themselves specially for his purpose. It is shown how experiments on the frog and tortoise may teach us lessons not only on the functions of the organs of these lowly animals, but also touching the origin, life, and behaviour of man himself. But while he deducts certain theories from these observations, he is careful to point out that theories are only scaffolding temporarily erected and later to be removed when their purpose is served. They must neither be despised, nor on the other hand regarded as able to defy the corrosive action of time. Physiology is a subject which touches the life of every individual, since the knowledge how man lives instructs him also how he ought to live. Professor Fano's generalisations are thus of great interest, although possibly some of his views may not meet with general acceptance, such as his rejection of the theory of evolution and his substitution for it of a potent "cosmic will" which moulds living things, using earlier forms to create new ones, better and stronger in their adaptations, although he admits this is more an act of faith than a working hypothesis. He also considers that living matter does not exist in the ordinary sense of the expression, but there are materials organised and utilised by the will to live.

The six chapters discuss in turn the so-called "living matter," some relations between inhibition and will, excitability, and automatism and their determination of cardiac peristalsis. The translation has been exceedingly well done.

NOTES ON BOOKS

An Introduction to the Practice of Preventive Medicine, by J. G. Fitzgerald, M.D., LL.D., F.R.S.C., University of Toronto (Henry Kimpton, 35s.). We had occasion to speak highly in praise of his first edition of this text-book. A second edition is now before us. As in the case of his best of American books dealing with Preventive Medicine, the sections bearing on Epidemiology are particularly well written and highly informative. The chapters in this work are of a high level of excellence. It is interesting to the British reader to note his advocacy of education, social reform, and law enforcement for the prevention and control of venereal disease. This is as it should be, but the people of this country, or it would be more correct to say sections of them, become hysterical when the suggestion is made to enforce the law against those who neglect treatment or while suffering from the disease refuse to submit to treatment. The food sections are also well done, and as can be expected, American progression in the production of pure milk is fully described. Altogether this book can be confidently recommended for the reliable information it contains. The publishers have done their part well.

Books Received

Should we be Vaccinated? by Bernard J. Stern, pp. 146 (Harper & Brothers), is a fascinating little book, crammed full of interesting information which provides a lucid survey of the vaccination movement from its earliest days. We learn that Jenner was not the earliest advocate of Vaccination by Cowpox, and also appreciate why opposition to Inoculation was conceived. Mr Stern's book can be profitably read by everyone. The question has been carefully studied, and a very complete bibliography proves how records have been searched to provide a lucid narrative. It is altogether a novel presentation of a subject. The small volume deserves a wide audience.

In the preface to *Aids to Tropical Medicine*, by G. E. Brooke (Baillière, 4s. 6d.), the author states that the publication of this new (third) edition has afforded an opportunity to revise the text throughout and to incorporate the most recent advances in tropical medicine. However, so rapid has been the advance that he has not been able to keep pace with it. Thus, for example, no reference is made to the recent work in India on the sand-fly as a transmitter of Kala Azar, or Noguchi's work on the etiology of Oroya Fever. An important error occurs on page 12. The author recommends three doses of 5 c.c. of *Chenopodium* in the treatment of Ankylostomiasis, obviously 0.5 c.c. is intended.

Ultra-Violet Radiation and Actinotherapy, by Eleanor H. Russell, M.D., B.S., and W. Kerr Russell, M.D., B.S. (E. & S. Livingstone, 15s.). This book, which has deservedly reached a second edition, deals very thoroughly with the whole subject of ultra-violet radiation in the treatment of disease. The historical aspect of the subject is briefly dealt with, and several chapters deal at length with the various forms of arc and mercury vapour lamps. The physical properties and biological effects of ultra-violet rays are outlined in an interesting way, the technique is clearly described, and there is a critical analysis of numerous cases treated. A useful bibliography and a good index complete a book which can be highly recommended to all medical practitioners who wish to acquire a knowledge of this subject.

BOOKS RECEIVED

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| BAILEY, HAMILTON. <i>Demonstrations of Physical Signs in Clinical Surgery</i> | |
| COOPE, ROBERT. <i>The Diagnosis of Pancreatic Disease.</i> (<i>Humphrey Milford, Oxford University Press</i>) | 21s. net. |
| COOPER, E. ASHLEY, and S. D. NICHOLAS. <i>Aids to Biochemistry.</i> (<i>Baillière, Tindall & Cox, London</i>) | 5s. net. |
| DORLAND, W. A. NEWMAN. <i>The American Illustrated Medical Dictionary.</i> (<i>W. B. Saunders Co. Ltd., London and Philadelphia</i>) | 4s. 6d. net. |
| | 35s. net. |

Books Received

- DUKE-ELDER, W. STEWART. Recent Advances in Ophthalmology.
(*J. & A. Churchill, London*) 12s. 6d. net.
- EVANS-WENTZ, W. Y. The Tibetan Book of the Dead.
(*Humphrey Milford, Oxford University Press*) 16s. net
- FALKNER, H. G. Actinotherapy for General Practitioners.
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DISCUSSION ON THE RELATION BETWEEN
PHARMACOLOGY AND CLINICAL MEDICINE.*

Opened by PROFESSOR A. J. CLARK.

The Transactions of the
Medico-Chirurgical Society
of Edinburgh

SESSION CVI.—1926-1927

~~Danger of slipping~~

The tendency to disregard the study of drugs is less marked to-day than it was at the commencement of the century. At that time the doctrines of therapeutic nihilism were dominant and the fashionable catchword amongst advanced physicians was, "You know I really never use drugs." This statement was of course really nonsense, for not even the most advanced members of this school of thought attempted to practise medicine without the aid of antiseptics, anæsthetics, purgatives or hypnotics, but none the less the phrase indicated a certain attitude of mind, which regarded drugs as at best mere palliatives and held that sera and vaccines were the agents from which the cure of disease must be hoped.

* Held 1st June 1927.

Books Received

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DISCUSSION ON THE RELATION BETWEEN PHARMACOLOGY AND CLINICAL MEDICINE.*

Opened by PROFESSOR A. J. CLARK.

THIS relation may be considered under three aspects: firstly, the value of pharmacological research; secondly, the place of pharmacology in the medical curriculum; and thirdly, the value to the clinician of pharmacological evidence regarding the action of drugs. Pharmacology is the study of the action of drugs on the functions of normal and diseased tissues, and therefore is based on physiology and pathology. Hence the former science could not commence until these latter sciences had reached a certain stage of development, and this made pharmacology a late comer amongst the medical sciences, for it was only founded in the latter half of last century and its chief development has taken place in the present century. Owing to this late development, pharmacology has had difficulty in establishing itself securely amongst the older medical sciences, but I hold that an accurate knowledge of the mode of action of drugs and of other therapeutic agents is an essential basis of rational therapeutics, and that unless this is present, therapeutics must tend to degenerate into a crude empiricism that is always in danger of slipping into charlatanism.

The tendency to disregard the study of drugs is less marked to-day than it was at the commencement of the century. At that time the doctrines of therapeutic nihilism were dominant and the fashionable catchword amongst advanced physicians was, "You know I really never use drugs." This statement was of course really nonsense, for not even the most advanced members of this school of thought attempted to practise medicine without the aid of antiseptics, anæsthetics, purgatives or hypnotics, but none the less the phrase indicated a certain attitude of mind, which regarded drugs as at best mere palliatives and held that sera and vaccines were the agents from which the cure of disease must be hoped.

* Held 1st June 1927.

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This attitude was the result of the course taken by the development of medical science during last century. The dominating event was the development of pathology which swept away all the vague doctrines of humours and diatheses and substituted a conception of disease as a process due to changes that could be recognised under the microscope. Morbid pathology thus reduced the study of disease to a science, and its triumphs were still recent memories when similar methods developed the vast new science of bacteriology, a science that revolutionised the whole of medicine and surgery, and during the last quarter of last century passed from one triumphant success to another.

Very naturally these spectacular successes quite eclipsed any progress made in the study of drugs, although the sum total of the advances made in pharmacology during last century was considerable. These advances consisted in two processes, namely, the introduction of new synthetic drugs and the elimination of useless drugs.

It is sometimes forgotten that practically the whole of the advances in medicine and surgery made last century were due to synthetic drugs, for anæsthesia and antisepsis both depended on compounds produced by the organic chemist. Furthermore, a large proportion of the most useful drugs at present in use in medicine were introduced into clinical practice as a result of pharmacological experiment during this period.

For example, during the period between 1860 and 1900 clinical medicine received from pharmacological laboratories the following drugs—all the hypnotics except opium and its alkaloids and bromides, all the antipyretics except quinine and the salicylates, and all the local anæsthetics, not to mention numerous other important drugs. The importance of this contribution to medicine can best be appreciated by considering the difficulty of practising medicine without these everyday remedies.

Pharmacology performed an almost equally great service during this period by its work of critical analysis of the action of drugs which resulted in ridding the pharmacopœia of a vast amount of rubbish.

Virchow had dismissed therapeutics contemptuously with the remark that if it was to progress it must free itself from uncritical empiricism and become a science. Pharmacology

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aided this process by demonstrating that the drugs of real value in medicine produced definite changes in function that could be demonstrated experimentally, and that most drugs that produced no demonstratable action under experimental conditions were inert when tested clinically.

The services of pharmacology to clinical medicine during last century were great, but there was a tendency to underestimate their importance because there were no spectacular triumphs.

The present century, however, has witnessed great advances in pharmacology. Two of the outstanding triumphs of medical science during the last twenty-five years are the development of chemotherapy and the development of endocrinology, and the discovery of salvarsan and of insulin are two of the chief events in the medical history of this period.

I consider that the discovery of salvarsan was one of the most important events in medical history. The addition of a drug of unprecedented value for the treatment of one of the most widespread and serious diseases affecting civilised communities was in itself an advance of great importance. But even more important was the fact that salvarsan represented the triumph of a new method. The essentially new idea was the building up of a synthetic compound to obtain an agent exactly suited for a specific purpose. I need scarcely remind you of the long years of patient research that were required to produce the final success, but the success, when it came, was a sensational proof of the possibilities of synthetic drug therapy.

This success has encouraged an enormous amount of research work along similar lines. No discovery as sensational as that of salvarsan has been made since, but such drugs as "Bayer 205" or Plasmochin promise to prove of a value only second to that of the organic arsenicals. The discovery that it is possible to find by systematic search synthetic compounds which will produce a desired therapeutic action has of course opened up vast possibilities for therapeutics. Fifty years ago the art of therapeutics was very largely limited by the number of compounds that happened to occur in nature, but in the future we may hope that the organic chemist will be able to supply compounds that will produce almost any pharmacological action that is required.

This enormous expansion of the field of therapeutic

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possibilities has resulted already in far greater attention being paid to drugs as specific remedies. The general opinion amongst medical men thirty years ago was that any important new cure would take the form of some new serum or vaccine, and drugs were regarded as rather out-of-date remedies. To-day, however, attention is focussed on the discovery of either new drugs or of new methods for administering old drugs with increased efficacy.

It is too early to pronounce judgment on the value of either sanocrysin in tuberculosis or of colloidal lead therapy in cancer, but it cannot be denied that these two forms of treatment are at present attracting great attention and even arousing definite hope of the ultimate discovery of some cure for these two chief scourges of modern civilisation. Time alone will show how far this hope is justified, but the point I wish to emphasise is that to-day attention is centred on the possibilities of the cure of cancer and tuberculosis by drugs, and this fact is an indication of a great increase in the belief in the possibilities of drug therapy.

It is fair to say that the advance made in our knowledge as to how the functions of the body can be controlled by means of drugs, and by synthetic drugs in particular, has been one of the most marked events in the history of medical science during the last twenty years, and there is no reason for supposing that this advance has now ceased.

The facts that I have mentioned are, I think, a sufficient defence of pharmacology as a subject for research. Indeed, it appears probable, that the chief advances made in medicine in the near future will depend upon organic chemistry. We must assume that most drugs of value that occur naturally have already been discovered, and that the discovery of new drugs will depend on the laborious researches in which organic chemists, pharmacologists and clinicians will have to collaborate: researches of the same type as those that led to the discovery of salvarsan. Such researches involve team work on a large scale, for it is usually necessary to prepare and test hundreds of compounds before any success is obtained. The conditions necessary for such researches have been organised in other countries, but unfortunately we are backward in this respect, and it is sad that in the last decade very few new synthetic drugs of importance have been discovered in this country. In my

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opinion one of the chief needs of medicine in these islands is the organisation of pharmacological research on an adequate scale which will enable us to compete with foreign countries in the discovery of new remedies.

Intensive pharmacological research is so obviously desirable that no further discussion is needed on this point, but the fact that a science offers great scope for research workers does not prove that it is of necessity a subject that ought to be included in the medical curriculum.

After all the main object of the medical curriculum is to train students to practise medicine. The time available is extremely inadequate for this purpose, and therefore I agree that the ordinary pass medical course ought to be devised with regard to the needs of the average student who will probably become a family doctor. I shall meet with universal agreement when I say that the modern medical curriculum is hopelessly overcrowded, and that no subject ought to be left in it unless it can be shown to be essential for the student's training.

Now the history of my Chair, as indicated by its title "The Chair of Materia Medica and Pharmacology," sounds a warning in this respect, for until comparatively recently the student's time was very largely consumed by learning to recognise the raw materials from which drugs were prepared, information which is almost completely useless to a medical man in the present century. This memory is a warning of the ease with which a useless subject may be preserved in the medical curriculum for generations, by the mere force of tradition and inertia, and naturally one views one's present teaching with a critical eye in fear lest a future generation may cast on it a similar reproach of uselessness.

I feel, however, that one can say with confidence that this is an imaginary danger, and that as long as medicine is considered as an art definitely based on science, so long will it be considered necessary for the student to possess a knowledge of the means by which the functions of the body can be modified by therapeutic measures.

At present the importance of this knowledge is increasing rapidly, for recent developments in medical science have increased the power of the doctor to modify the progress of disease by drugs. At the same time the potency of modern drugs makes them very dangerous tools in the hands of the

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ignorant. This fact is exemplified by the strict accuracy of dosage and technique that is needed for the successful administration of such drugs as salvarsan or insulin. One may indeed remark in passing that there is no drug that produces any definite physiological effect that can be used with safety by those ignorant of the general principles of its mode of action.

I think that even those who still doubt the general efficacy of drugs as curative agents will at any rate agree as to the disastrous results that can be produced by their improper use, and that therefore a knowledge of the actions of drugs is an essential part of the training of the medical student.

I am not, however, content with claiming that pharmacology is an essential portion of the medical curriculum, for I would go further and say that a study of the general principles upon which the art of therapeutics is based deserves a higher place in the curriculum than it is generally given.

Here, in Edinburgh, we are fortunate in having a rational curriculum in which the student after studying physiology and anatomy spends a year in the study of pathology and pharmacology, whilst at the same time he is introduced to his clinical studies. In many schools, however, this is not the case, and pharmacology is tucked in anywhere in the course.

This disregard of pharmacology is due to historic reasons. Morbid pathology was the first medical science to evolve, and as a result has attained, and has since maintained, a somewhat disproportionate importance in the medical curriculum.

There are two groups of basic medical sciences: firstly, those which are concerned with the form of the body, namely, anatomy, histology and morbid pathology, which subjects are particularly important for the diagnosis of disease; and secondly, those sciences concerned with the functions of the body, namely, physiology and pharmacology, and these are the basis of the cure of disease.

Bacteriology and parasitology are intermediate sciences; their dependence on histological methods caused them at first to be closely linked with pathology, but the modern development of chemotherapy have established a close connection between bacteriology and pharmacology.

The study of form is simpler than the study of function, and naturally anatomy developed before physiology, and morbid

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pathology before functional pathology and pharmacology. As a result, during last century medical science concentrated on the study of the changes of structure and form produced by disease. This study established medicine as a science and led to an enormous advance in the science of diagnosis. These benefits were, however, accompanied by certain drawbacks, for this devotion to morbid anatomy led to a state of affairs in which the ward tended to be regarded as the anteroom of the post-mortem chamber, and those cases were termed complete which the physician had failed to cure. In fact there was a danger of diagnosis being regarded as an end and not a means to an end, and of therapeutics being neglected in consequence.

The advent of bacteriology introduced very important new methods of treatment but did not fundamentally change this attitude. My contention is that the rise of physiology, and the great development of pharmacology, ought to result in medicine, and particularly in the teaching of medicine, changing its orientation and devoting more attention to the functions of the body.

It is of course essential that the medical practitioner should know his way about the body and be just as familiar with its normal arrangement as he is familiar with the rooms and furniture of the house in which he lives, but it seems equally necessary that he should understand the principles determining the normal functions of the body and the significance of any deviation of function from the normal.

My general conception is that just as anatomy, histology and pathology constitute one side of a student's education, and are chiefly devoted to the study of the form of normal and diseased tissues, so physiology and pharmacology constitute another side which is concerned with the consideration of the functions of the body in health and disease and the mode in which these can be modified by therapeutic remedies, and I claim that the latter group ought to have at least as much attention paid to them as the former group.

The question as to the relative value of pharmacological and clinical opinions regarding the action of drugs is unfortunately somewhat controversial.

The laboratory worker and the physician are bound to look at the same problems from different standpoints. The laboratory worker can choose his problem and arrange his controls so as to attain very fair accuracy. But the physician's

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problem are cases that demand immediate treatment and who cannot be told to wait a few years while certain preliminary fundamental problems are investigated. Moreover, as each case is a separate entity, entitled to the treatment that has the greatest probability of success, it is extraordinarily difficult to arrange controls in clinical work.

Consequently the clinician regards the laboratory worker as a theorist ignorant of the requirements of practical life, whilst the laboratory worker, proud of his complete and carefully controlled observations, is in danger of forgetting the enormous difference there is between the healthy animal on which his experiments have been performed and a diseased human being.

This diversity of outlook always has existed and is always bound to exist, and all that one can ask is that each side should recognise the difficulties besetting the other's work and the fact that success can only be achieved by a collaboration between laboratory and clinical worker.

This diversity of outlook is apt, however, to be aggravated in other ways. There is an unfortunate tendency for commercial enterprise sometimes to outrun established fact in therapeutics. This tendency is well illustrated in certain branches of endocrinology. Persons thus employed resent being asked to offer definite evidence for the statements that their advertisement writers utter in their more inspired moments. Consequently they are very forward in their denunciation of pharmacology, and wax eloquent on the impudence of theorists who try to dictate to practising doctors the choice of their drugs.

I think that the following is a fair summary of the attitude of most clinicians towards pharmacology. The clinician has to provide treatment for his patients. There are a few diseases for which specific cures are known, but in most diseases treatment must be palliative, and anything that makes the patient more comfortable may be of value. The variation in diseased conditions and the response of patients to drugs forms a problem far more complex than anything dealt with in the laboratory, and therefore the value of drugs cannot be assessed finally by means of a few crude laboratory tests.

Now this sounds a very convincing argument, but historical evidence shows that this line of thought involves certain very real dangers.

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Every laboratory worker knows that no experimental result is valid unless subjected to rigorous controls, for every one knows the astounding power of the mind to warp experimental results so as to bring them into line with preconceived ideas.

Now in clinical work this danger is doubled or rather squared, for the faith of the doctor in a drug is reinforced by the faith of the patient in the doctor's faith. Furthermore, there is always the difficulty or rather impossibility of arranging controls.

Hence comes the extraordinary difficulty in assessing the value of a drug in clinical medicine. The only way to estimate this difficulty is to recollect the wildly erroneous opinions regarding drugs that have been held in the past. I might just mention a single instance which is recorded by Sir Leonard Rogers. The proper use of cinchona bark in malaria was fully expounded by Lind in the eighteenth century, but this was completely abandoned in India in the first half of the nineteenth century, and it was agreed that quinine ought not to be given until the fever had subsided and the acute stage of the disease was treated with heroic doses of calomel. I cannot think of a more remarkable case of clinical opinion ignoring what to-day appear to be the most obvious facts in favour of a preconceived idea. The possibility of such an occurrence helps us to understand why no rubbish ever put on the market for the cure of disease ever failed to get medical testimonies as to its value. The whole history of therapeutics shows that it is most exceptional for any advance to be made and to be maintained without the collaboration of the laboratory.

It is easy to show how inadequate laboratory tests are for the estimation of the clinical value of a drug, but as a matter of historical fact it is the drugs that produce definite and measurable effects that maintain their position in medicine.

My whole paper is really an appeal for the definite recognition and practical application of the doctrine that therapeutics is an art based on the science of pharmacology. This can only be achieved if there is collaboration between clinicians and pharmacologists, and this means a good deal of patience both in the ward and the laboratory, for both sides will have to spend time in proving points that they think to be self-evident.

The production of a new edition of the *pharmacopœia*

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will afford an excellent opportunity for the practice of mutual tolerance. A satisfactory result can only be achieved if there is close collaboration between the workers in the ward and in the laboratory. Progress however will not be assisted by the clinicians accusing the pharmacologists of attempting to dictate to doctors the drugs they are to use whenever the laboratory worker asks for definite evidence that a drug has an action. On the other hand, the pharmacologist must remember that even though a drug does not produce an action on a laboratory animal, it does not follow *ipso facto* that its clinical use is merely the survival of a mediæval superstition.

DISCUSSION.

Professor Murray Lyon said: The Society may congratulate itself on having heard from Professor Clark the views of one of the most advanced pharmacologists in the country. I think we may admit that the lecturer has justified his subject and its position in medical teaching. With regard to his definition of the subject I would take issue with Professor Clark. He has limited it to a study of drugs and their uses. Fortunately, in his lectures, or in his admirable little book, he does not limit himself in that way. There are many other remedial agents besides drugs which should be taken into account, and the old title of the Chair—*Materia Medica*—would appear to be worth retaining, if it is understood to cover a study of all methods and procedures which aid in the fight against disease. Professor Clark has called attention to one of the most remarkable and fascinating advances in recent times—the chemical development of salvarsan is one of the wonders of modern medicine. It seems nothing short of miraculous that a chemist, knowing little of medicine and the conditions of treatment required, should evolve a substance of high importance and such great value. In endocrinology perhaps the field is even more promising. The structure of adrenalin has long been known. Thyroxin has quite recently been synthesised, and probably within a short time we will be able to reproduce in the laboratory every endocrine substance. That may lead us still further, because the knowledge of the constitution of these substances will indicate to us the raw material from which the body can build up the endocrine products. With regard to vitamins, the field is very encouraging. Recently one vitamin has been synthesised, and before very long others will doubtless be separated and concentrated. The advances in the commercial preparation of vitamins have been very encouraging. Professor Clark has mentioned the commercialisation of drugs, and that is one of the objectionable

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features of present-day medicine. All of us are inundated with samples, and appeals to try this or that new remedy. Many of these appeals are supported by chemical formulæ, and they all have testimonials from medical men—usually from persons whose standing is uncertain. The information given of tests carried out is very meagre. It seems that there ought to exist in the country some body whose function it is to have these things weeded out. To a certain extent, the Therapeutic Substances Bill will deal with the question, so far as the more potent drugs are concerned, but some drastic action should be taken with regard to the vast numbers of new remedies which flood the market. Most of the new preparations get their reputations from their action on animals, but undoubtedly before a reputation can be fully established, careful clinical tests must be made. Within recent years three such tests, on a fairly large scale, have been carried out in the case of insulin, sanocrysin, and more recently a substance to be given by the mouth in diabetes—synthalin. Each of these substances is dangerous—highly dangerous—if used indiscriminately. Fatalities have been produced, I believe, by each of them, and such substances ought to be very carefully examined and a satisfactory clinical knowledge of them acquired before they are broadcast throughout the country. Then with regard to teaching, Professor Clark has opened up a very fascinating subject. Medical education has always been a subject of controversy. I take issue with Professor Clark on the exact position in which he places pharmacology with regard to clinical medicine. He speaks of clinical medicine as being a science of form, but I think that modern clinical medicine concerns itself very largely with abnormalities of function, and rightly so. Clinical tests for function have been greatly elaborated and are carried out now as part of the routine in most modern teaching institutions. It seems to me, however, that perhaps the most important part of the teaching of clinical medicine is really that of diagnosis by the evidence of disturbed function. The student must learn how to make his diagnosis, and he must be able to carry this knowledge with him for the rest of his life. It is the ABC of the profession. He must carry with him some knowledge of treatment, but this is of less importance as the practitioner can always get access to journals and text-books where he will get the latest views on treatment. He needs to know how to make his diagnosis first of all, otherwise his treatment will not be of very much value.

Sir Norman Walker said: I was hoping to hear some of the clinicians first, but there are points in connection with medical education about which I should like to say a word or two. Professor Clark has referred to variations in the teaching in different places. It has been my lot recently to see a good deal of other schools, both in this

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country and in India, and I have watched particularly the teaching of this subject. I do not know any subject in the curriculum in which there is more difference of practice than in the teaching of materia medica. I have found it taught in the first year along with chemistry and anatomy, in the second year along with anatomy and physiology, and in the third year, as here. So far as Scotland is concerned, Professor Clark is preaching to the converted, because of the four Scottish Universities, three have full-time professors of pharmacology, and the subject is taught after the students have learned anatomy and physiology. He used the word "basic" of the science of pharmacology. I should rather think a little bit of the wall would be a better description. Anatomy and physiology are often spoken of as "fundamental" subjects. Then one learns that below them it is important to have chemistry and physics, and I am now firmly convinced that general education is the most important of all—that unless the boy or girl who enters medicine has been properly educated in general knowledge, he (or she) will never make a really good doctor. But it is not all the student's fault. I have heard lecturers whose lectures consisted in reading from notes from Hale White's book. I have heard lecturers—and still more, examiners—who seemed to think that the number of preparations of a substance in the pharmacopœia was still an important part of that subject. And this is not limited to the East. I have heard again and again, at examinations, students asked the question as to what are all the preparations of so-and-so. It does not matter in the least what they are.

I do not know a more misunderstood volume in the world than the British Pharmacopœia—it is a list, so that if you want to order drugs you know what you are ordering.

It is thirteen years since the present pharmacopœia was published and the metric system adopted. I wonder how many schools are using that system. Edinburgh is one, but the majority still cling to the old methods. I think it will do an immense amount of good in medical education if teachers, like Professor Clark, will speak out boldly and say what they think is the proper place for pharmacology in the curriculum. That it should follow physiology seems to me to be absolutely plain, and the closer the better. I have a very firm conviction that it is better to have a class running for several terms twice a week than crowded into two terms even if it meets for two hours every day. The student's mind takes up the subject better when it is spread over a longer period of time.

Dr Lambie said: Pharmacology has not only had great achievements in the past, but it is likely to have still greater triumphs in the future. Professor Clark has taken a very wide view of his subject, but

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as things are at present, it is necessary to recognise that it has certain limitations. Pharmacology, after all, includes the action of drugs on the human subject and in disease, hence a certain number of clinicians may view with a certain amount of misgiving the fact that pharmacology, according to present arrangements, is cut off from experiment and observation upon the human subject, and is practically confined to animal experimentation. Now this is a matter of only recent development—this divorce between clinical therapeutics and pharmacology—and it is important to consider its effects: firstly, the influence it has had upon the teaching of medical students; and secondly, its influence upon pharmacologists; and thirdly, upon pharmacological research.

As regards the teaching of students, I think the change has not on the whole been altogether for good in certain medical schools; that is to say, where a chair of pharmacology has been established but where no provision has been made for a further course of lectures on clinical therapeutics. It is absolutely essential that the course of pharmacology, which is often given by one who is not, and may never have been, a practical physician, should be supplemented by a course of clinical therapeutics, as in Edinburgh. Where this ideal arrangement does not exist, I think I would say the old arrangement was better, so far as the student is concerned, namely, where the professor of pharmacology and materia medica was also a member of the hospital teaching staff.

With regard to the effect upon pharmacologists themselves, the tendency has been, I think, in many cases, to cause them to forget their essential function. Pharmacology has not the same claim as physiology to be regarded as a pure science. The physiologist investigates the function of the body with a view to the attainment of knowledge, not necessarily with any practical end in view, whereas the aims of the pharmacologist are largely, though not entirely, practical. Where this is forgotten, pharmacologists tend as it were to go astray. While there can be no definite boundary between physiology and pharmacology, there is no doubt that the bulk of the work done in pharmacological laboratories is pure physiology and has no claim whatever to be regarded as pharmacology. This lack of orientation also leads to the carrying out of a lot of work which does not throw any particular light upon the functions of living tissues and which is in fact neither of scientific nor practical value. I therefore heartily endorse Professor Clark's appeal for a better organisation of pharmacological research.

Dr Rutherford said: I am glad that an opportunity has been afforded for the discussion of the present position of pharmacology. Without wishing to be captious, I think the title of this discussion is termino-

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logically inexact, and that it could more appropriately have been termed "The Place of Pharmacology in Clinical Medicine." As regards the question of a more adequate organisation of pharmacological research, I agree that the need for this is urgent. In any further development in this direction the need for the application of the pharmacological method to the problems of practice in clinical medicine ought to be faced and more fully recognised than it has been for a considerable number of years back. The pharmacologist to-day is too much an experimentalist and too little a physician. Whether professors of materia medica should be physicians to teaching hospitals or not is a different question. Professor Clark raises the question of modification of the medical curriculum so as to bring it more into line with modern medicine. I hope that whatever alterations may result there will be no new arrangements made which tend to occupy the time of the medical student more than it is at present. The student of clinical medicine, at present, is so occupied with various other subjects that he does not appear to have sufficient time to think properly about the clinical problems which the wards present. This is a serious matter, for a medical student, unless he specialises in some surgical department, will eventually be almost entirely concerned with the various aspects of clinical medicine. I doubt if Professor Clark is preaching the right text when he pleads for greater study of disordered physiological function, and somewhat deprecates the great attention which in the past has been paid to diagnosis on the basis of morbid anatomy. The clinician after all is much concerned with disordered function—probably more so outside hospital than inside. And it seems to me that the science dealing with the functions of the body are fairly adequately represented in the medical curriculum as it is at present, and has been for many years back—in Edinburgh at all events. I am one of those who think that the tendency in recent years, on the scientific side, to concentrate attention on the study of disordered function, as it is termed, has led the medical student and some of his teachers into a position where the paramount necessity of accurate diagnosis on a structural basis has been to a serious extent lost sight of. There can never be any question, as far as my understanding goes, that clinical medicine is based most correctly and most safely on a knowledge of morbid anatomy, in the first instance, and that diagnosis and treatment cannot be properly attempted unless the clinician visualises morbid anatomy in the living body as well as in the dead-house.

Dr Goodall said: Any criticisms I make are directed against systems and not individuals, and my fighting instincts are not aroused

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against Professor Clark because I am in close agreement with nearly everything he has said. I think he might have emphasised the potent influence which fashion exerts on medical practice. In this Society we have had discussions on such things as the cacodylates, sour milk, the formates, and other equally useless substances, now mercifully dead and buried. The present fashion seems to be the injection of malaria into sufferers from general paralysis. Those who practise this may have profound knowledge of general paralysis but must have little experience of malaria. I have seen too many cases of death and insanity following infection by the simple tertian parasite ever to wish to give it artificially. I think, however, that there will be agreement with Professor Clark in his main thesis. Where he will arouse discussion is in connection with the curriculum, and if it had ever been his fate to teach clinical medicine in the University of Edinburgh he would have expressed himself more strongly. I agree with Dr Rutherford's caveat about the importance of morbid anatomy as distinguished from functional tests. We probably get nearest the truth about things when we can get them on a commercial basis. The commercial aspects of human life are expressed in terms of life insurance. The life insurance medical officer has little use for functional tests. He is interested in one function—the function of life—and expenditure of calories and CO_2 are to him things of ephemeral interest. I hold that what is wrong with the curriculum is the unqualified teacher. This of course raises a controversy between the merits of a professional school and a university. In Edinburgh we are troubled with the German system of watertight compartments. There are chemists who have no interest in biology, biologists innocent of pathology, physiologists who know nothing of medicine, and anatomists who care not about surgery. There are among us the maimed and the halt who suffer because they received injections of quinine into the sciatic nerve during the war. There is probably not a student from the second year onwards who could not recite the origin of the gluteus maximus. I wonder how many have been warned not to inject dangerous drugs near the sciatic nerve. Here lies the difficulty in our clinical teaching. The clinician has to begin with anatomy, go on to physiology, then to pathology. Near the end of the hour he is in a position to discuss symptoms. He may reach diagnosis. I may be slow, but it is many years since I have reached the question of treatment. But I decline to discuss treatment with students who do not understand the condition we are treating. I wish the representatives on the General Medical Council here could get a regulation passed that every teacher in the medical curriculum should be able to pass an elementary examination in pathology and clinical medicine.

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Dr Huskie said: I should like, from my own experience, to say what I feel is the use of pharmacology to men in general practice. As I get older, the fewer drugs I use, and I am forced to the conclusion that, from the practitioner's point of view, the most essential thing for him in the course of his training is to get a thorough knowledge of anatomy and physiology. Although pharmacology is very essential in general practice, there are not very many affections for which you really require drugs. I should rather look to the chemical therapist or biochemist to help us out. The health of the community depends on its food, and if we cannot get a proper food-supply and understand what takes place during digestion, and in the way the food is absorbed, we do not make any progress in practical treatment.

Dr Fleming said: My own feeling is that we are entering upon a new era and that a teacher of clinical medicine ought to have had personal experience both of practical pathology and of pharmacology. Professor Clark should lay claim to a share in the new Clinical Research Laboratory. I cannot believe that any man can be an expert pharmacologist unless he has the opportunity to carry out a permissible amount of observation on the human subject. Clinical experience is infinitely more valuable than mere experience of the action of drugs on animals, however valuable such work may be.

Dr Douglas said: I belong to the older school, and it was my privilege to have learned my materia medica under Sir Robert Christison, a very cultured gentleman. I happened to be looking over my notes that I had taken in his class, and in a lot of them there was the hieroglyphic "N.T.D." "N.T.D." did not refer to the New Town Dispensary, but referred to the fact that the drug opposite which it appeared was noted by Sir Robert Christison as having been known to "Dioscorides!" giving you an idea of the depth of his learning, and perhaps of the ancient nature of the knowledge we were receiving. I understand from Professor Clark that all that is a thing of the past. I feel inclined to join issue with Professor Clark when he tells us that most of our valuable drugs to-day are synthetic drugs. I wonder if I am to call cod-liver oil a synthetic drug, because there has been put forward a thing which is called "morrhual," which, I presume, is a synthetic preparation from cod-liver oil. I have never thought of using it. I stick to the old-fashioned cod-liver oil. In the same way, I do not know whether we would call strophanthin a synthetic drug. Iodides, too, are of great value; I do not believe these are synthetic. We have, in these past centuries, made a great mistake in regarding disease as a thing to be studied only in the wards of the hospital, and particularly the results

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in the dead-house. Mackenzie has changed all that. That is probably the greatest advance in modern times—namely, that we ought to study medicine as a preventive thing, and we are to study our patients before they have got to the hospital stage, when the disease is in an advanced condition. That is the great thing in the future for medicine, and it will lie largely with the men in general practice.

Dr Fergus Hewat said: We teachers of clinical medicine have to keep vividly in mind our enormous responsibilities. I think the bulk of us are grateful for the physiological and pharmacological teaching that the students receive before they come to us, because it relieves us of some of our responsibilities. We have primarily to teach diagnosis. It is, as I understand it, our main object to give our students a clear conception of the principles and characteristic features of disease, and give them, so far as we can, an idea of treatment, in which, of course, the exhibition of drugs is a small part. Some people consider it a large part. That is a matter for the training and experience of the physician. As *Dr Huskie* has said, the older one grows, the fewer drugs one uses. I have not grown very old yet, but I certainly tend to employ fewer drugs in practice than I used to do.

I often ask students, when they come back as graduates, to criticise our teaching and show us our faults, and two things especially have been insisted on: (1) A thorough examination of cases. This, they tell me, is one of the principles the student does not fully appreciate in his student days, but he does appreciate it in practice. In Edinburgh, I think we do try to put before our students the complete examination of our cases. (2) A fuller consideration of treatment—they mean treatment in the widest sense. They expect a little more knowledge of prescriptions. Some of us endeavour to meet them from time to time, either at the end of out-patient clinics or of clinical lectures.

I think that our co-operation with our pharmacological friends is adequate. At times, of course, we have to wait before pronouncing a new drug a success or not. In the case of synocrysin, for instance, Denmark says it is good. Professor Rist in Paris has tried it and found it wanting. America has tried it experimentally on animals but failed to reproduce what Denmark showed, and in the Eastern States they have never used it at all on patients. Sir Robert Philip, in co-operation with Professor Murray Lyon, has used it in a certain number of cases, and Professor Murray Lyon showed us, not long ago, his results. He was optimistic, but I was impressed with one fact, that all the patients, except one, lost weight under treatment.

We, as clinicians, have to wait, and sometimes wait a long time, before we can definitely establish the fact that a new drug is good or not.

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Dr Leebody said: We are, I am afraid, forgetting that in the old days we were taught what suited our environment. It seems to me to be on an analogy with the instruction in navigation—the instruction required for sailing ships is of no value for steamships, but it does not mean that the instructor in the days of sailing ships was wrong. There is a tendency to say that our teachers did not teach us in the best way; but they gave us knowledge which was to cope with the circumstances with which we had to deal in those days. I think it is equally on an analogy with the fuel used in machinery—in the old days they used coal, to-day they use petrol. We cannot run down the man who taught us the use of coal because it is of no use to us now; we want to know how to use petrol. As science advances we must advance with it, and we must not blame our teachers in the past if they have not taught us to cope with present-day difficulties.

Dr Somerville said: Drugs are less used in hospital than in general practice, and the majority of practitioners of the present day are under the National Health Insurance Act. More than half of the drugs used in general practice are used under that Act. That system has one very serious flaw—the absurd emphasis that is laid on economy. That is stultifying much advance amongst practitioners in their national health work. Much of the time of the panel committees is spent criticising prescriptions which have been issued by newly-qualified doctors—who write expensive prescriptions—the prescriptions they got from their teachers. It is difficult at times to justify the inclusion of some of the ingredients in these prescriptions.

Dr Stevens said: I think the main conclusion we have to draw is that we ought to see and hear a great deal more from Professor Clark and other pharmacologists than we have in the past. A lot of the details about medicines taught by Sir Robert Christison and Sir Thomas Fraser did not prove useful to us afterwards, but I would like to know whether the students of to-day do not have to learn a good deal that is of little use to them. We want to learn more about pharmacology certainly, but I think we will always have a bit of empiricism in the actual treatment of disease, however thorough our knowledge of the scientific basis on which medicine rests, we must take the patient with all his idiosyncrasies into consideration as well as the disease.

Dr Chalmers Watson, Dr Keppie Paterson, and Dr Frederick Porter also spoke.

Professor Clark (in reply) said: It is very necessary for a teacher of a medical science to keep in touch with the clinical side, and it has been instructive to hear what you practising physicians think of the

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views that I put forward. I hope that nothing that I said will be taken as criticism of my distinguished predecessors. I only mentioned the historical fact that the learning of certain subjects had gone on long after they had lost their value, because this fact is a valuable warning as regards present teaching. I must take issue with Dr Chalmers Watson about the amount of progress that has taken place in medicine in recent years. After all, the discovery of salvarsan and insulin alone are pretty good advances for twenty-five years. First-class advances cannot be expected monthly. During the last twenty-five years several other remarkable advances have been made in the treatment of tropical disease—for instance, the use of emetin in amœbic dysentery, and of antimony in bilharziasis: these discoveries have been of enormous importance in certain areas of the world. We, in this country, are fortunately spared a large proportion of the worst diseases in the world, but the value of vitamins in preventing and curing rickets is an advance of the greatest importance for this country.

The statement that the number of drugs used could be reduced to less than a dozen raised a question that interests me greatly, because I am always trying to cut down the number of drugs taught and can never get it down to less than about one hundred and fifty. One must remember that such drugs as anæsthetics, antiseptics, and local anæsthetics have to be included. It is surprising how many drugs are indispensable for one purpose or another. Dionine, for instance, is only used for one purpose, but the ophthalmologists tell us they find it very useful.

With regard to National Health Insurance, I quite agree that it is necessary to consider the needs of panel practice carefully in teaching prescribing.

Sir Norman Walker's remarks about the place of pharmacology were most interesting. In Edinburgh it has a satisfactory position, but my views on this subject are possibly rather jaundiced, because for six years before I came to Edinburgh I had to teach pharmacology to students who had not finished their physiology, and, of course, it is perfectly impossible to teach the action of drugs on the functions of the body if the students do not know what these functions are.

As Professor Murray Lyon has mentioned, the scope of "pharmacology" should be extended and the subject should not be confined to drugs. It should include, apart from drugs and dietetics, as much general information as possible about the manner in which the functions of the body are affected by therapeutic measures. My idea is that pharmacology ought to be the link between physiology and medicine. The students must first learn the normal functions of the body and then they should be taught how these functions are disordered by disease and the manner in which the normal and disordered

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functions can be influenced by therapeutic measures. Students may learn physiology very well and yet never apply their knowledge to practical medicine. I admit it would be better if I were to do clinical medicine as well as laboratory work, but unfortunately one has only a certain amount of time, and it is very difficult to keep in touch with the developments of modern pharmacology and also do clinical medicine. I am afraid I do not quite make my point about the position of morbid anatomy. My general idea was that of the late Sir James Mackenzie, namely, that the end-results of disease are of less importance than the disorders of function that finally cause these end-results.

Exhibition of Specimens

Pathologist's Report on Ovarian Tumour, by Professor Teacher.—

The tumour is larger than a coco-nut, and on section shows fairly solid tissue with numerous cysts of small size and some clear nodules resembling cartilage. Microscopically it is a teratoma of very complicated type. There are cartilage, dermoid cysts, and glandular structures and cavities lined by epithelium which suggest respiratory and alimentary tract. Other areas are composed of tissue resembling the embryonic nervous system, viz., neuroglia and tubules lined with epithelium which suggest the central canal of the cord.

There are also areas of very cellular malignant-looking tissue of indefinite type. There is no definite malignant growth in the sense of sarcoma or carcinoma, but the omentum contains portions of the tissue resembling embryonic nervous system (both central canal and glia). The tumour must be regarded as malignant.

31st May 1926.—Dismissed from the wards to-day. Convalescence uneventful: temperature subsided within twenty-four hours of operation. Abdomen still distended—median mass extends to within 1 in. of umbilicus but tender—more or less rounded. Bladder empties regularly and completely. Mass is dull to percussion but resonant at the sides. Dullness in flanks—varies with position of patient: probably a little free fluid in the abdomen. Per rectum mass felt: somewhat irregular and softer than on examination prior to operation. Circumference of abdomen at the level of the umbilicus is 28 in.

Subsequent Progress.—The family physician reported to me that after the patient's return home she had a considerable amount of discomfort, with occasional vomiting. Three weeks after dismissal she had a sudden profuse vaginal hæmorrhage and expired. It would appear to me that this vaginal hæmorrhage was caused by the pelvic tumour burrowing through the posterior fornix.

Similar cases have been described by Porter, Miles, Williamson, Falk, Briggs, and Walker. The most recent which I have observed was described in the *Zeitschrift für Geburtshilfe und Gynäkologie*, November 1926, by Stellakatu working in Vienna.

(3) **Primary ovarian carcinoma from patient aged 16.**—E. B., aged 15½. P. 14. M. 3/28. No dysmenorrhœa. About a year ago the patient had a pain in her right side, which lasted for a day or two. She remained perfectly well until 27th March 1927 when she again had slight pain in the right side. She consulted her doctor, who noticed the abdomen was distended and sent her to hospital. She had not herself noticed any swelling of the abdomen and had no other symptoms. She was admitted to the Royal Infirmary on 7th April 1927. Her last menstrual period commenced on 8th March 1927. Examination showed the abdomen protuberant, a solid mass extending up to the level of the umbilicus. It was comparatively

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mobile and extended downwards into the pelvis: moderately firm in consistence: not tender to palpation. The abdomen was opened on 8th April 1927. A solid ovarian tumour was found, rising from the left adnexa, with its lower free pole in the pouch of Douglas. The left broad ligament was very vascular, with huge veins, the ligament having been stretched over the tumour. The tumour was removed and the pedicle tied off. There was no indication of any metastatic growth. The opposite adnexa appeared quite clear: the omentum was clear. No other lesion, which could be identified as a possible primary lesion, could be found anywhere in the abdomen. The tumour measured $7\frac{1}{4}$ in. by 5 in.

Pathologist's Report, by Professor Teacher.—This is a carcinoma of very cellular type. The cells are large and clear with large heavily chromatined nuclei. They present a certain amount of resemblance to the cells of the membrana granulosa of the Graafian follicles but are larger.

Karyokinetic figures are numerous and in some areas there are hæmorrhages and degeneration of the tumour cells. In my opinion it is a primary ovarian carcinoma. This type of carcinoma of the ovary is not common in my experience. Those which I have seen have been principally adeno-carcinoma developing on the basis of the colloid ovarian cystoma.

The patient's convalescence was quite undisturbed and she left hospital on 24th April 1927. Her physician reported on 28th May 1927 that she was still very well.

(4) **Chorion epithelioma of the ovary.**—Mrs L., aged 27; married four years; has had three children. Puberty at 14. Menstrual type—three-day period, with an interval varying from twenty-one to twenty-eight days. Has had slight dysmenorrhœa and slight leucorrhœa. Her three labours have been abnormal—she was twice delivered with instruments and once by version from a transverse presentation. She was admitted to the Royal Infirmary on 28th April 1927. A month before admission the patient began to have pain in the lower abdomen, occasionally severe enough to make her sick.

Her last menstrual period commenced on 11th March 1927. There is a history of two definite occasions on which coitus occurred, namely 4th and 25th March. On 3rd April she had slight pain in the lower abdomen, which became gradually more severe. On the 16th April there was hæmorrhagic vaginal discharge, pale in colour, with what the patient described as "white streaks" through it. The discharge was scanty and lasted for three days. The abdominal pain of which she had complained appeared to be relieved by the flow. She had had pain on defæcation for a week before admission but no dysuria.

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29th April 1927.—The patient was examined under an anæsthetic to-day; the uterus was found slightly enlarged with little impairment of mobility. In the right lateral fornix a rounded swelling could be felt, apparently adherent to the side of the uterus. The left adnexa appeared normal. The consistence of the swelling and the clinical history appeared to justify a diagnosis of tubal mole or circumscribed hæmatocœle.

Operation.—On 2nd May 1927 the abdomen was opened. A small amount of recent, free blood was found in the pelvis. The right Fallopian tube was normal in appearance and ran across the top of a rounded swelling attached to the posterior surface of the broad ligament and to the right edge of the posterior surface of the uterus. At the upper outer pole of this swelling a portion of normal ovarian tissue was identified. The remainder of the swelling appeared of dark brown colour and obviously contained a lot of effused blood. The whole surface was fairly smooth. A presumptive diagnosis of ovarian pregnancy was then made. There was no evidence of a corpus luteum on the right ovary—a separate corpus luteum has usually been described in ovarian pregnancies. The left adnexa appeared perfectly normal; the left ovary also showed no corpus luteum. The tumour was shelled up from the posterior surface of the broad ligament and removed without disturbing the right Fallopian tube. There was slight oozing from the raw surface thus created but not sufficient to require drainage. The abdomen was closed in the usual way.

17th May 1927.—On the third day after operation there was slight staining from the vagina, which persisted for three days. No fragments could be obtained for examination. Her convalescence in other respects was singularly uneventful and the patient was discharged from hospital to-day with instructions to return for re-examination.

Pathologist's Report, by Professor Teacher—May 1927.—This was a mass about the size of a hen's egg consisting of a large amount of blood-clot which apparently distended the ovary. The surface of the mass was ruptured on the hæmorrhagic side showing a cavity. On splitting the tumour the pale tissue apparently was ovary, follicles being visible in it but there was no corpus luteum. The hæmorrhage was fairly sharply defined from the ovarian tissue and there was a pale line along the border line which suggested the growing margin of chorion-epithelioma, rather than any structure that would be seen in an ovarian pregnancy. Microscopic sections showed this line to be typical chorion-epithelioma malignum.

The question arises whether this is a teratomatous chorion-epithelioma or a chorion-epithelioma arising from an ovarian pregnancy or a secondary to a uterine tumour.

There is no evidence in favour of teratoma or a primary uterine

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tumour. The absence of corpus luteum can be accounted for by the activity of the chorion-epithelioma, which is invading the neighbouring ovarian stroma, having destroyed it.

Examination of various portions of the blood-clot failed to reveal chorionic villi.

In my opinion, it is most probable that the tumour is a primary chorion-epithelioma of the ovary, which has developed on the basis of an ovarian pregnancy.

DISCUSSION.

Dr Fordyce said Professor Hendry was lucky in having such an authority as Professor Teacher behind him. The last specimen was a very extraordinary one, for in any case an ovarian pregnancy was a rare occurrence, and that one should have, in addition to this, a malignant degeneration of the chorion, made the case still more extraordinary.

Dr Haultain asked Professor Hendry in regard to his specimen of carcinoma of the ovary in a young girl, if he thought that the prognosis was good or bad. He had a somewhat similar case in a girl, aged 21, who had carcinoma of the ovary one and a half years ago. There did not seem to be any marked metastases elsewhere, and she was now going on well without any recurrence.

Dr Fahmy, commenting on the third specimen, said that Professor Hendry had mentioned that the carcinoma gave the impression that it might have been derived from the cells of the membrana granulosa. That condition had been described under the name of malignant folliculoma of the ovary. It was extremely rare, a few cases only had been reported. Dr Fahmy had seen one case of this nature. In reporting on a fibrotic uterus, removed at operation, routine examination of the ovaries was also carried out. In one apparently healthy ovary the whole ovarian tissue was replaced by large spheroidal cells. The section was submitted to Dr Dawson (of the College of Physicians Laboratory) who designated the condition as one of malignant folliculoma. The other ovary was normal.

The operation had been performed some two years ago and the patient was known to be still in good health.

Professor Hendry said he was greatly indebted to Professor Teacher, whose pathological reports on the specimens gave them their real value. That was particularly true in the last case, in which the condition was one of very great rarity.

With regard to the prognosis in the case of primary ovarian carcinoma, the fact that the tunica albuginea appeared intact in all the sections examined probably indicated a relatively good prognosis. The tumour appeared to correspond, as Dr Fahmy suggested, to a malignant folliculoma.

SPONTANEOUS RUPTURE OF THE UTERUS, BEFORE OR DURING LABOUR.*

By PROF. JAMES HENDRY, M.B.E., F.R.F.P.S. (Glasgow).

RUPTURE of the uterus is one of the greatest disasters of pregnancy—a grave danger for the mother and a much graver one for the child. It may occur (1) unexpectedly and without warning in the course of pregnancy; (2) under similar circumstances in the early stages of labour; (3) at the end of a prolonged, obstructed labour, associated with a definite train of warning symptoms, the recognition of which might have secured its prevention. Those types make up the group of “spontaneous ruptures.” Lastly, it may result from certain methods of terminating labour, either by the use of forceps or crushing instruments, or by intrauterine manipulations involving forceful alteration in the position of the fœtus. Such types of rupture are classed as “traumatic.” We may have to add to this class the type of rupture resulting from the use of such powerful oxytocic drugs as pituitary extract.

This communication deals only with cases of “spontaneous” rupture, even though, particularly in hospital practice, the incidence of “traumatic” rupture is considerably greater. By this statement about the greater frequency of traumatic rupture, I do not reflect upon the efficiency of hospital practice: at least two types of cases are dealt with in maternity hospitals—(1) those which have been under the care of the hospital from the beginning of labour, and (2) those which are only sent to hospital after difficulties have either presented themselves or failed to respond to treatment outside.

Within the past three years I happen to have dealt with a series of four cases of either threatened or actual spontaneous rupture of the pregnant uterus, the clinical and pathological features of which have been so different as to make them appear worthy to be brought to the notice of this Society. As the clinical histories are interesting, and from many points

* Read 8th June 1927.

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of view important, I shall report them in what may appear considerable detail.

CASE I.—In the first case of the series, actual rupture did not take place. The patient, aged 34, had had two difficult labours. As far as the history of the first labour could be ascertained, she had version performed because of a transverse presentation, but the child was still-born. Her second confinement took place in Barshaw Hospital, Paisley, where she was admitted in labour. I saw her then, found the foetus lying transversely and the cervix fully dilated. There was no pelvic deformity, and I had no difficulty in performing version and securing a live child. At the time I thought the patient had a cordiform uterus, though there was no marked vertical sulcus at the fundus. In view of her obstetric history, she was advised to come in to Barshaw Hospital before labour, if she did become pregnant again. She was readmitted on 5th January 1925; labour appeared to be due about 27th January. Two days after admission, the house surgeon noticed that the uterus had a peculiar shape. On the right side the fundus appeared to be considerably higher than on the left, and this difference in height appeared to be progressive. The house surgeon found that the height of this right portion increased by one inch in a period of twenty-four hours. The uterine wall appeared to be very thin. The patient complained of a feeling of discomfort in her epigastrium; there were no evident painful contractions. On 10th January I was asked to see the patient. To me it appeared that the uterus was lying obliquely, with a fairly large subserous fibroid on the left side. Such an interpretation was difficult, because there had been no evidence of a fibroid when I saw her some eighteen months before. This right portion of the uterus had a very thin wall; foetal parts could be felt with "uncanny" distinctness, but the uterine wall could be made to contract over the foetus by gentle massage. The foetus lay obliquely, the head lying above the brim on the left side of the pelvis, and the breech directed towards the right. I believed that if this process of distension were allowed to go on, the uterus would probably rupture, so I decided to perform Cæsarean section. On opening the abdomen I found the uterine wall to be singularly thin; on incision it was not more than one-eighth of an inch in thickness. I removed the foetus through a vertical incision in this thin wall. The child was alive and did well. I everted the uterus to control hæmorrhage while removing the placenta and membranes. I found considerable difficulty in removing the membranes from the left side of the uterus. They seemed to lie over a cavity containing some dark coloured fluid. My first thought was that I was dealing with a necrotic fibroid, but I discovered that it was really a portion of the uterine cavity which

Spontaneous Rupture of the Uterus

had been shut off by the membranes. The dark stained fluid flowed out of this cavity quite easily. I performed supra vaginal hysterectomy. The patient's convalescence was absolutely undisturbed, and she left hospital in excellent condition on the twenty-fourth day.

Investigation of the uterus after removal showed that it was really a double uterus, with a vertical septum extending from the fundus throughout the whole length of the upper contractile part of the uterus. I stitched up the uterine incision and filled the whole cavity with pledgets of wool soaked in formalin solution so as to preserve the outline of the uterus. You now see the specimen after preservation.

I believe that in the previous pregnancies the ovum made use of both compartments of the uterus during development in such a way as to flatten out the septum. Certainly in her second labour the head was on one side, and the breech at the same level on the other side. In this third pregnancy the ovum seems to have developed entirely in one half of the uterus. The left half took no part in accommodating the ovum, and appeared as a tumour-like protuberance on the side of the gestation cavity. This resemblance to a fibroid tumour has been previously described in cases in which pregnancy occurred in one half of a double uterus.

CASE II.—The patient, aged 20, came to my Antenatal Dispensary at the Glasgow Royal Maternity Hospital, towards the end of her second pregnancy. Her first pregnancy had ended in a Cæsarean section, performed at one of the local poor-law hospitals. Labour was expected in the third week of November 1924; her Cæsarean section had been performed in May 1923. I sent her in to the Antenatal Wards on 28th October, according to what is almost our routine practice in "repeat" Cæsarean sections. Her true conjugate diameter at the brim was estimated at $2\frac{1}{2}$ inches. On 30th October she was anæsthetised for examination purposes. On the following day she had a good deal of sickness, which was regarded as ordinary post-anæsthetic vomiting. Next day she was more comfortable, and had very little sickness. On 2nd November she complained of epigastric pain, but this was thought to be due to retching. On 3rd November I was asked to see her as she was still occasionally sick and had a good deal of abdominal discomfort. Her appearance was good; her tongue was slightly furred; pulse rate was 84 (it had never been higher); her temperature was normal. There was no abdominal rigidity or distension, but just tenderness on pressure practically all over the lower

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portion. Just above the umbilicus I could feel foetal limbs with special distinctness. I could not hear a foetal heart. Gentle massage failed to produce any response from a uterine wall. No separate rounded swelling, such as the contracted, empty uterus might have formed, could be identified. There had not been any vaginal hæmorrhage.

On investigating her history more carefully, I found that at 9.30 P.M. on 30th October the patient had had a great deal of abdominal discomfort, so much that the sister on duty thought she was going into labour. This severe discomfort did not last more than half an hour, and then eased off fairly quickly.

On 3rd November rupture of the uterus was diagnosed. On opening the abdomen I found the foetus, placenta, and membranes lying free in the abdominal cavity. The omentum was stained with blood, but there was practically no free blood. Having removed the products of conception I found the uterus lying behind and below the foetus. It was firmly contracted: running vertically along the anterior wall was a rough tear with everted edges, into which I could put three fingers quite easily. Satisfactory repair of this tear seemed impossible, so I removed the uterus by supravaginal hysterectomy, stitching the cervix over completely.

The actual time of rupture in this case is difficult to determine. Though it may have occurred on the evening of 30th October, the foetus and placenta were in fairly fresh condition when they were removed from the abdomen on 3rd November. The placental site was on the posterior wall of the body of the uterus.

There was an immediate post-operative rise in temperature, but within twenty-four hours it had fallen again to normal. Even after operation the pulse rate was only 90, and it never rose higher. The rest of the convalescence was perfectly uneventful.

I was able to obtain the following details from the surgeon who performed the previous Cæsarean section on 21st May 1923:—(1) The patient was admitted to hospital on 21st May 1923. Vaginal examination was made then, and the fact established that she would require Cæsarean section. No other vaginal examination was made. (2) The operation was performed three hours after labour had commenced. (3) The placenta was found on the anterior wall, and there was considerable hæmorrhage on opening into the uterus. (4) Iodised catgut was used for stitching the uterine wall in two tiers.

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(5) With the exception of a rise to 100·6 on the day after operation, the temperature was normal. The skin wound healed by first intention. The lochial discharge was normal throughout the whole course of the puerperium.

CASE III.—Multipara, aged 30. Her first four labours were instrumental, carried out in domestic practice; the fourth child was still-born. Two years before her present admission the patient had her fifth child born spontaneously in the Royal Maternity Hospital.

The patient was admitted to hospital at 11 P.M. on 7th November 1926. She stated that she had had slight labour pains at infrequent intervals since 11 A.M. that day. She walked up to the hospital. She had every appearance of being at full time. The presenting part, the head, was still at the brim but hardly fixed: the back lay towards the left, the limbs to the right and unusually far forward. The foetal heart was most easily heard, below and to the left of the umbilicus. External pelvimetry gave an interspinous diameter of 10½ inches, and an intercostal of 11½. On vaginal examination the sacral promontory could not be reached. The cervix was taken up, and the external os admitted four fingers. The membranes were intact but slightly sausage-shaped. The anterior fontanelle was easily felt. The sutures were normal in character, and the degree of ossification normal.

At 2 A.M. as the head did not appear to have made any advance, the patient was re-examined. The os was almost fully dilated, the membranes were bulging, and accidentally ruptured during examination. By 4 A.M. the labour pains had become stronger, but were normal in character. Temperature 97; pulse 60. Abdominal palpation showed the head to be better engaged, with very little overlap. At 7 A.M. vaginal examination showed that there was still a rim of cervix to be taken up; a very marked caput had formed. The pains were now much less frequent and less severe than before. Her condition remained unchanged, slight pains at wide intervals, until at 9.30 A.M. the sister-in-charge of the Labour Ward noticed that the patient was a little cyanosed about the lips and over the malar bones: her expression was anxious; temperature 98; pulse 100. The abdomen was lax and the foetal parts were easily palpable. Vaginal examination showed the cervix still incompletely dilated, but the rim of cervix was now lax and the presenting part freely movable. The house surgeon made up his mind that the uterus had ruptured.

I saw the patient at 10.15 A.M. Her condition was just as has been described: pulse rate still 100. There was no abdominal rigidity. A mass occupied the pelvic brim and the middle lower abdomen. Gentle abdominal massage failed to elicit any contraction of the uterine wall over the foetus. The foetal heart could no longer be heard.

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There was some vaginal hæmorrhage, or rather vaginal oozing. There was a good deal of tenderness over the lower abdomen, but I was able to move the lower pole of the fœtus above the pelvic brim.

Having agreed with the diagnosis of rupture of the uterus, I opened the abdomen at 11 A.M. I found the fœtus, placenta, and membranes free in the abdominal cavity, the head directed downwards. The uterus lay behind and to the right of the child. There were from six to eight ounces of free blood in the abdominal cavity, but there was certainly no violent hæmorrhage. The child was, of course, dead: it weighed $9\frac{1}{2}$ lbs.: the position of the caput showed that the presentation had been a brow. I found a vertical tear on the left anterior aspect of the uterus, the peritoneal rent being situated between the left round ligament in front, and the Fallopian tube and infundibulo-pelvic ligament behind. There was œdema and hæmorrhage into the cellular tissues over the left lower portion of the uterus. I removed the uterus by supravaginal hysterectomy. I found it a little difficult to pick up the vessels on the left side of the cervix, owing to the amount of extravasated blood. I closed over the cervix but packed the little gap on the left side at the seat of the tear with iodoform gauze, thrust right down into the vagina, closed over the pelvic peritoneum completely, and ran two pints of gum acacia saline solution into the peritoneal cavity. The patient was in a satisfactory condition at the end of the operation. You now see the specimen after preservation.

On the day following operation the condition was very good; pulse 100; temperature 99° . The temperature remained between 100° and 99° for a week, the pulse varying from 92 to 80. From then onwards temperature and pulse remained perfectly normal and the patient was dismissed from hospital well at the end of three weeks. On examination before dismissal I found the vaginal vault clear and without induration. I could distinguish an old cervical tear in the left anterior portion of the cervix.

The course of rupture in this case was most interesting—one could not have had a better example of “silent” rupture. The pains were never excessive, either in severity or frequency.

Attention was drawn to her condition by the alteration in her facies only. Additional special features in this case are the history of four difficult instrumental labours; the identification of an old cervical tear; the size of the child, and the brow presentation.

CASE IV.—A multipara, aged 30, with five previous pregnancies. Two of them are reported to have ended in difficult, instrumental

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labours. She was seen on the hospital district on the afternoon of 29th December 1923 by the sister-in-charge of the district, who reported that the patient was having strong pains, the os dilated to a coffee-cup size, pulse 120, and that she was making a great noise. Even after admission to the hospital she remained very noisy, and there was evidence that she had been drinking methylated spirit. Her pains had actually commenced about 11 A.M. and the membranes ruptured at 4 P.M. Examined at 5 P.M. after admission to hospital, the head was found movable at the brim, the os dilated to a diameter of $2\frac{1}{2}$ to 3 inches; the membranes had ruptured, and the vertex was presenting. There was a slight overlap but it seemed likely that the head would be driven through. The patient was so noisy that she was given $\frac{1}{4}$ grain morphia. At 9.30 P.M. the head was found to be fixing in the brim, with the posterior fontanelle directed backwards. The temperature was 97 and pulse 78 (pulse had been 120 when she was admitted). The pains were fairly strong. She was again causing so much disturbance that another $\frac{1}{4}$ grain morphia was given. By midnight the pains were less frequent and less strong; the patient was drowsy. The pulse rate had now risen to 118. Examination showed that though the head was more fixed it had not made any appreciable progress. Later, it was found that the pains had become stronger and the patient more disturbed after 2 A.M., and that about 3 A.M. she described a "tearing" pain referred to the umbilical region. She was found asleep at 4 A.M. The pulse rate was then 120. She continued to sleep throughout the early morning and was not re-examined until 10 A.M. Then the foetal head was found in the right iliac fossa. The lower portion of the abdomen was very tender. The head had moved away from the brim and the umbilical cord was found in the vagina. The cervix seemed about $2\frac{1}{2}$ inches in diameter but was perfectly lax. The temperature was 99 and pulse 118. I saw her at 11 A.M. when she looked ill with all the appearance of an "acute abdomen." There was acute tenderness over the whole surface, but particularly just above the symphysis pubis. There was a trickle of dark-stained blood from the vagina. By this time the pulse rate had risen to 140. The head appeared to have escaped through the uterine wall but the body of the child was still within the uterine cavity. With the patient anæsthetised I put my hand into the uterine cavity and extracted without difficulty, by the breech, a child which had been dead for some hours. The placenta was easily expressed. I found that there was a complete rupture of the uterus in the anterior wall of the lower uterine segment. Her pelvis was of the flat variety, but the degree of deformity was slight. Even now there was only a steady trickle of dark blood from the vagina. After an emergency preparation I opened the abdomen and found that the uterus

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had been torn through in a horizontal direction, just above the reflexion of the bladder. The tear commenced just in front of the left side of the uterus and passed right round and slightly downwards, tearing through the main vessels on the right side, and for about an inch on to the posterior surface of the lower uterine segment. The actual remaining attachment of the uterus was only 2 inches in breadth. There was very little blood in the abdominal cavity. The vessels in the right broad ligament appeared retracted and closed. The uterus was removed by supravaginal hysterectomy. There was some ecchymosis into the tissues of the left side of the broad ligament. I closed over the cervix completely, except on the right side, which I packed with a little iodoform gauze thrust down into the vagina. The peritoneum was completely closed over.

The patient's early convalescence was disturbed by an acute bronchitis, amounting almost to a broncho-pneumonia. For about six days the temperature ran up to 102° to 103° ; pulse 110 to 130; and respirations 30 to 40. There was a good deal of muco-purulent sputum. After that the whole condition improved, and she had a steady convalescence. She left hospital in good condition on 11th February. I have seen her on various occasions as an out-patient at the Royal Infirmary, where she attends because of prolapsed vaginal walls.

The important features in this case are the excitement and shouting of the patient on her admission to hospital, apparently due to alcoholism, which led to the free administration of morphia. The occipito-posterior position and the slight disparity between head and pelvis were not sufficiently appreciated. The uterus appears to have ruptured about 3 A.M., but the anodyne action of the morphia masked the symptoms of rupture. There was very little free blood in the abdominal cavity, and the amount of hæmorrhage throughout the whole incident was comparatively slight. The post-operative chest condition may have been due in part to the administration of ether, which was given in preference to chloroform because of the patient's collapsed condition.

Ætiology.—While a series of only 4 cases does not afford much scope for discussing the ætiology of "spontaneous rupture of the uterus," I have tried to estimate the importance of various factors by studying the records of 54 other cases of spontaneous rupture, published in the *Journals* since 1st January 1926. I have not been able to get complete access to all the

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records, but in 40 of the cases the ætiological factors have been considered. What has impressed me most is that it is seldom possible to ascribe the rupture to one cause only.

The predominant factor in this series appears to be the scar of a previous Cæsarean section—actually in 21 of the cases. Two of the 21 cases had had two previous Cæsarean sections. Particularly interesting is the inclusion of 2 cases in which the section had been of the lower uterine segment type; in one of those the section had been performed in a case of placenta prævia—my own least satisfactory experiences of the lower uterine segment operation have been in two cases of placenta prævia. Professor Kynoch communicated quite recently to this Society Wittenwald's analysis of the results of 2600 cases of the lower uterine segment operation, with a record of subsequent ruptures in only 0.28 per cent.

Of 16 of those 21, I find that rupture occurred in 9 during the course of pregnancy, and in 7 during labour. Two of the latter group were actually having labour induced in the hope of securing a natural birth, and under such circumstances other factors have to be considered such as the effect of quinine, pituitary extract, or the introduction of bougies.

The relationship of the classical Cæsarean section scar to subsequent rupture depends on a series of factors which have been discussed and re-discussed in recent years. In my second case the scar seems to have given way throughout its whole extent. The original placental site had been on the anterior wall, and the suture material was iodized catgut: the original convalescence was quite afebrile, and the placental insertion in the second pregnancy was on the posterior wall.

A history of damage to the uterine wall, associated with either previous intrauterine manipulations such as version, manual removal of the placenta, difficult forceps delivery or curettage, or of actual disease of the uterine wall following septic abortion, a septic puerperium or other inflammatory lesion occurs in 10 of the 40 cases. In one a Sturmdorf amputation of the cervix had been previously performed. In another rupture occurred at the seat of an old perforation made by a curette. Particularly interesting is a case reported to this Society by Dr Farquhar Murray, in which rupture occurred through a local degenerative lesion in the posterior wall of the uterus, while there was a Cæsarean section scar on

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the anterior wall.¹ There was one conspicuous absence from the list of damages to the uterine wall—I ~~did not find~~ any record in this series of a rupture following the operation of myomectomy. When one considers the frequency with which this operation is now performed, and the extent of the disturbance of myometrium and even endometrium which may be produced by it, one might almost expect to find the uterine wall impaired in a subsequent pregnancy.

In my third case it appears very likely that the previous instrumental labours had been associated with a deep tear of the cervix and that the fibrous tissue gave way in this labour at an early stage. Ivanoff² describes this vertical type of tear as occurring specially frequently in cases of generally contracted pelvis. In my case there was a large child presenting as a brow: while there was little diminution in the pelvic diameters, there was certainly no flattening of the pelvis. In my fourth case there had been difficulty with previous labours and the pelvis was slightly flattened—Ivanoff did associate transverse tears of the lower uterine segment with medium degrees of flat pelvis. In my first case, while the development of the ovum in the right half of the uterus was probably the most important factor, there may have been some damage to the myometrium produced at either of the previous versions.

~~In 4 cases out of the 40, pituitary extract was regarded as the causal factor, and this group includes the only case in which rupture of the uterus occurred in a primigravida.~~ The effect of pituitary extract depends very much on the method of administration as regards time and dose, and to some extent on the preparation used. While over forty prominent French and Spanish obstetricians³ report no actual case of rupture following the use of pituitary extract under their own observation, Sherill has recently collected 24 cases in which pituitary extract has been entered as the cause of uterine rupture.⁴ While the administration of pituitary extract does not occur in my small series of cases, I have seen some cases of traumatic rupture in which I believed that the administration of pituitary extract had been an important factor.

In five cases, prolonged labour due to various abnormalities in presentation or position, or to slight disparity between the presenting part and the pelvis, was given as the cause of

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rupture. These included one face presentation, two neglected transverse presentations, one in which an ovarian cyst impacted in the pelvis had not been diagnosed, and one of pelvic disproportion. In one of the neglected transverse cases the pregnancy had occurred in a subseptate uterus. There is no mention in the series of dystocia due to hydrocephalus, which I have seen in hospital practice as a not uncommon cause of rupture, though it has usually been complicated by attempts at delivery with forceps.

In my third and fourth cases I have already referred to the possible importance of a brow presentation in the one and an occipito-posterior position in the other as ætiological factors.

Symptomatology.—There is a certain classical picture of rupture of the uterus which appears in text-books, lectures and examination questions. The patient has a rising pulse and temperature, a rising Bandl's ring, uterine contractions increasing in severity, frequency, and duration until a crisis is reached. Then there is a moment of agony associated with a feeling of tearing; the pains stop suddenly, and the patient passes rapidly into a condition of profound collapse. It is difficult to focus such a picture in any one of my four cases—it is most nearly reached in the fourth, but even there the picture was blurred by the effects of morphia. My first case does not require special consideration, as the evidence of probable rupture was judged from the changes in the form and consistence of the uterine wall.

Pain and Collapse.—In the series of recently published cases already referred to, an adequate account of the symptoms was given in 22 cases. Six of these had ruptured during pregnancy: 4 of the 6 had acute abdominal pain with profound shock; one, the same symptoms with the addition of sickness and the sixth, severe shock with pain in the region of the umbilicus. In my second case, which ruptured about the 37th week, there was never any degree of shock; the pulse rate never rose above 84 and its quality was splendid. She had only abdominal discomfort, with epigastric pain and some sickness. These symptoms were so comparatively mild as to be taken for post-anæsthetic vomiting.

In 16 cases which ruptured during labour only 7 are stated to have had acute symptoms, including acute, sudden or

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sustained, abdominal pain with rapidly following symptoms of shock, including the characteristic changes in pulse and temperature. One suffered from profound shock without complaint of pain, but here the administration of morphia and scopolamine probably obscured the picture. In the remaining eight of this group, no considerable part of the fœtus had escaped from the uterine cavity. In four of them a diagnosis was not made until persistent post-partum hæmorrhage and profound shock at the end of the third stage of labour, led to a manual exploration of the uterus. In two the rupture was not diagnosed until a disturbed puerperium led to an abdominal operation, in one case, thirty days after labour. In the two remaining cases the rupture is simply stated not to have been diagnosed.

In cases of rupture during the early stages of labour there is usually severe pain and very marked disturbance, but in my third case the rupture was of a most perfect "silent" type, though she had no sedatives administered. The uterine pains were never violent or continuous; there was no complaint of severe general abdominal pain, and the signs of shock were only developing when the diagnosis was made.

If there is a type in which the classical symptoms of rupture should occur, it is that occurring late in labour. In my fourth case the pulse rate was rapid from the time of admission; labour pains were very strong but morphia obscured the symptoms to such an extent that even after the occurrence of rupture she fell asleep and continued in this state for several hours. When seen seven hours after rupture, she was certainly profoundly shocked.

One symptom is sometimes referred to in cases of rupture of the uterus, viz., pain in the back and in one or other shoulder. This symptom did not occur in any one of my cases.

While the symptoms of spontaneous rupture may be obscured by the use of anodynes, they are almost certain to be in the case of traumatic rupture where the patient is usually under an anæsthetic when rupture occurs. It is therefore almost essential that where there has been extensive interference, or a difficult forceps delivery, the uterus, and particularly the lower uterine segment, should be carefully explored at the end of the operation.

Physical Signs.—It is frequently stated that where rupture

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has occurred, the firmly contracted uterus can be identified apart from the foetus. In none of my cases was this possible, because the uterus lay behind and underneath in each case.

The easy palpation of foetal parts is usually described, but I have often felt foetal parts through a relaxed, thin-walled uterus, just as distinctly as I ever felt them when the child was free in the abdominal cavity. I do attach considerable importance to the fact that when the uterus is unruptured, gentle massage can usually stimulate the uterus to contract sufficiently well to make its wall appreciable in front of the foetal parts.

Unusual mobility of the foetus has been mentioned as a common sign, but I have found the degree of abdominal tenderness, though not extreme, sufficient to prevent this sign being elicited.

In most cases of rupture, certainly in all of mine, the foetus was dead and foetal heart sounds absent. In some of those case reports which I have referred to, the foetal heart was heard and the foetus recovered alive.

The abdomen has been described as firm and even distended. In none of my cases was there any rigidity or actual distension. There was certainly tenderness on pressure all over the lower abdomen, but even there it was not extreme. If there was any variation in tenderness it was more pronounced in the iliac fossæ.

A most important sign is the recession of the presenting part from its position in the pelvic brim—this was present in my third and fourth cases. It may not be present if the head has gone into the pelvis before rupture occurs.

Amount of Hæmorrhage.—The amount of intra-abdominal and external hæmorrhage in cases of rupture seems to vary very greatly. In ruptured Cæsarean scars the amount of hæmorrhage seems to depend on the situation of the placenta. When the placenta is exposed through a small rupture in the scar, intra-abdominal hæmorrhage may be extensive, but where the ovum is extruded sharply into the abdominal cavity as in my second case, the amount of hæmorrhage may be very slight.

In my fourth case, where a transverse rupture had torn right through the vessels at the base of the right broad ligament and gone round practically two-thirds of the circumference

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of the lower uterine segment, there was very little either internal or external hæmorrhage. This was due to the complete severance and retraction of the vessels.

The greatest amount of bleeding in my series occurred in the third case, and even there the amount of blood in the abdomen was not any more than six to eight ounces. The external loss also was trifling.

It may be taken that the collapse which occurs in many cases of uterine rupture is due to surgical shock, rather than to extensive intraperitoneal hæmorrhage.

Treatment.—All my cases were treated in the same way—by supravaginal hysterectomy. All three rupture cases were complete, and in two the fœtus had passed into the abdominal cavity, making a laparotomy inevitable. In case No. 4, though the body of the fœtus was still inside the uterus and was extracted *per vaginam*, the separation of the lower uterine segment was so extensive that there also hysterectomy was inevitable. The destruction of uterine wall in case No. 2 was so extreme as to make a satisfactory suture unlikely, and in the third case a repair would have been both difficult and tedious in a patient who was suffering from shock before the operation commenced. One might suggest complete hysterectomy, rather than the less drastic supravaginal operation which was carried out: while complete removal of the cervix has advantages in a presumably infected case, particularly of the traumatic type, it did not appear necessary in my series.

REFERENCES.—¹ *Edinburgh M. J. (Transactions)*, 1927, xxxiv., 92.
² *Anal. de gynéc.*, 1904, August, September, and October. ³ *Rev. franç. de gynéc. et d'obst.*, 1925, xx., 270. ⁴ *Surg. Gynec. and Obstet.*, 1926, xlii., 661.

DISCUSSION

Dr Fordyce, in commenting on the small amount of hæmorrhage which had occurred in two of Professor Hendry's cases, where he gathered also that the placenta and fœtus were lying in the abdominal cavity, said that in two of his own cases where that had taken place, there was a large hæmorrhage, and he had wondered whether the amount of blood had come from the laceration of the vessels or in the course of the separation of the placenta. One would think that the separation of the placenta and expulsion into the abdominal cavity would be associated with a considerable amount of hæmorrhage, and might also contribute to the shock. In Professor Hendry's cases

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that was not so. The amount of shock in his experience had been very limited. In one case where there was a marked degree of shock, the Resident thought that the patient had some cardiac failure, and it was only on careful examination that it was found that a considerable amount of dark blood was coming from the vagina, and on palpation one came to the conclusion that probably the uterus had ruptured. She was a multiparous patient who had had nine children and who was over-due, and it was decided to start labour if possible by pituitrin. After the second dose the patient had sudden, violent pain and was moved to the Labour Ward, after which she began to have these heart symptoms. It was thought that this was the result of the pituitrin. There was a very free hæmorrhage going on which was certainly from the laceration which had torn through the uterine artery at one side. In another case of rupture of the uterus which he had seen there were very few symptoms of shock, such as is generally described in the ordinary symptoms of rupture of the uterus. This was diagnosed by the hæmorrhage which was coming from the vagina, a certain degree of rapidity of the pulse, and the feel of the tear. In another case of a mal-developed uterus, the rupture caused great difficulty in diagnosis, for there was not much shock but a marked increase in the pulse rate. It was only after exploring the interior of the uterus that one discovered it was quite empty. There seemed to be a tumour at the side which was thought to be a fibroid tumour, and one could not find any rupture of the uterus. On opening the abdomen it was found to be a rupture of a pregnancy that was situated in an isolated cornu of the uterus, having been impregnated from the other side. The fœtus had escaped into the peritoneal cavity. The uterine horn contained the fœtus in this case. It had evidently thinned out when the rupture took place. There was no bleeding at all.

He would like to ask Professor Hendry what was the experience of the Glasgow Maternity Hospital with regard to rupture after Cæsarean section, because he was astonished at the large percentage of ruptures in the series of cases mentioned by Professor Hendry. Had these cases been done in emergency, in private practice, and had they been done by surgeons accustomed to doing that operation?

He thought Professor Hendry had done great service in emphasising the varied symptoms that could be found, as one was apt to teach the students the usual classic symptoms. Professor Munro Kerr had emphasised some of the same points which Professor Hendry had now brought out from the experience he had had.

Dr Haultain said he had recently come across a case of rupture of the uterus which had given rise to great difficulty in diagnosis. The diagnosis was only reached on account of the extreme pallor and

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collapse of the patient. She had had a Cæsarean section done a year before and was eight months pregnant. When she appeared at the antenatal department she felt all right, but the next day she felt a little uncomfortable, and the day after she had a so-called "fit." She went unconscious and frothed at the mouth. She was unconscious for three hours. When she got better she refused to go to the Maternity Hospital. That same evening she took another "fit"—frothed at the mouth and went unconscious again. She did not recover consciousness and was sent to the Maternity Hospital. When seen on admission she was pulseless and barely conscious. One wondered if this was a rupture or a very bad case of eclampsia. On abdominal palpation one found the abdomen quite flaccid, no signs of peritoneal distension or rigidity. The uterus seemed normal, but the head of the foetus could be felt immediately under the ensiform cartilage apparently outside the uterus. On catheterising the bladder only 2 oz. of urine were found. The patient's only chance was to open the abdomen at once. This was done and a rupture was found which had gone through the whole length of the previous Cæsarean scar. The child and part of the placenta were out in the abdomen, which was full of blood.

Professor Hendry's case was examined under chloroform previous to rupture. This patient had come to the antenatal department previous to rupture, and had been examined by the Resident in order to find the position and presentation of the child, etc. Dr Haultain wondered if, in these cases, abdominal palpation might have been a contributory fact in bringing about the rupture, and, that being so, if it would not be better to leave previous Cæsarean sections alone in future pregnancies as regards palpation and not touch them at all.

Dr James Young some time ago saw a patient who was at about full-term. She had sudden acute pain in the abdomen. She was not feeling very well and the doctor thought it might be an appendicitis. On examination she did not look ill; the pulse was normal; the temperature was normal. Four or five days afterwards she looked as if something was wrong; the abdomen started to swell and there was a slight degree of temperature. The abdomen was very tympanitic. It was decided then that it was a possible case of rupture. When the abdomen was opened the foetus was found to have escaped through a rent in the uterus, which was contracted and lying down in the pelvis. There was no intraperitoneal bleeding. The comparatively slight symptoms which she had to begin with and which passed off quickly had no doubt been caused by the rupture of the uterus. The case seemed a good example of Dr Hendry's "silent" rupture.

Dr Douglas M. Lindsay said the first case mentioned by Professor Hendry, in which the ovum developed in one half of the uterus,

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recalled a case of considerable interest. The case was brought in to the Maternity Hospital late in labour with a fully dilated cervix and an impacted shoulder presenting. The child was alive and he was optimistic enough to expect delivery by version. After some time it was realised that the cause of the trouble was that the uterus was cordiform and the head had been firmly fixed in one cornu and the breech in the other. The patient was watched through the succeeding pregnancy, and from the seventh month the child lay transverse. Before term external version was repeatedly done and binders and pads put on. Eventually the membranes ruptured, practically with the beginning of labour, and again the lie was transverse. It was decided to perform Cæsarean section. In this particular case there was no question of one cornu having developed at the expense of another; the whole septum was quite definitely present. The cordiform outline of the uterus was seen by casual abdominal inspection. Dr Lindsay thought that if one had to deal with a cordiform uterus with a transverse presentation on one occasion, one should not take the chance on a second occasion, but should submit all such patients to laparotomy Cæsarean section and sterilisation.

It was illuminating to note from recent literature on statistics of uterine rupture that roughly 50 per cent. were due to rupture through the Cæsarean section-scar, and it was equally illuminating to notice that the lower uterine segment-scar was not entirely blameless. If an upper uterine segment scar was giving considerable doubt on that account, and the lower uterine segment operation performed more frequently, it was quite probable that the percentage of lower uterine segment ruptures would be higher in the next five to ten years. Spontaneous rupture found in the lower uterine segment following instrumental delivery must be classified to some extent with the rupture following Cæsarean section-operation. He was looking on those two groups not as spontaneous ruptures but as delayed traumatic ruptures. The damage done by the forceps operation was unavoidable damage damage done during Cæsarean section was deliberate damage and the desirability of permitting a delayed traumatic rupture to occur through a deliberate scar in the uterus raised the question of sterilisation. Should one deliberately produce a scar and leave it to be subjected to strain during the next pregnancy?

Dr Lindsay had only seen one case where rupture could be attributed to pituitary, and in that case the patient was really dead on admission. She lived 20 miles out of town and forceps had been applied to the head at the brim. After forceps had been applied the patient was collapsed and she was sent in to hospital with a small note explaining that she had been stimulated with 2 c.c. of pituitary. The rupture started in the lower uterine segment just over

Professor James Hendry

the promontory of the sacrum and extended through the upper uterine segment to the fundus. On post-mortem examination the abdomen was found filled with blood as in the case mentioned by Professor Hendry.

Dr Fahmy showed a uterus recently obtained at a post-mortem examination in which rupture had occurred.

The patient, aged 40, was a multipara. Her five living children had been born spontaneously, the largest at birth being $8\frac{1}{2}$ lbs. She went into labour at term, the membranes ruptured early; and the doctor, seeing her within four hours of the onset of labour, found a head and a hand presenting. The hand was pushed up, the head worked over the brim, and forceps applied to fix the head, but without success. The patient collapsed and was left with the head still free. Later in the evening, forceps were again applied, but as the condition of the woman was poor, an ambulance was ordered to take her into hospital. She had a sudden free hæmorrhage before she left the house, and became almost pulseless. On arrival, the patient was collapsed, there was no fresh bleeding, and the head was still above the brim. As there was no clinical evidence of rupture of the uterus, the woman was allowed to rest quietly in a warmed bed and was given a sedative. In a couple of hours the general state was much better, and contractions recommenced. The head was found to be engaging quickly, the os being fully dilated; descent continued but vaginal bleeding now recurred and the patient became restless. Rupture was again considered but no real evidence was found, unless the tear was a slight one. Ether was given, and a forceps delivery was carried out without difficulty. Bleeding continued slowly; the placenta was therefore removed, no tear being felt. The uterus was lightly packed to save even slight loss. The baby was born dead, due to intraeranian hæmorrhage. The patient slowly sank and died in an hour or so.

Post-mortem examination showed a rupture right across the anterior wall of the lower uterine segment, the tear being only partly through the thickness of the wall. There was some blood in both broad ligaments. The rupture probably occurred at the time when the forceps slipped off the head when it was still free at the brim.

This case bore out Dr Hendry's statement that shock may follow comparatively slight ruptures of the uterus.

Dr Fisher said that two years ago he had a case of rupture of the uterus somewhat similar to Professor Hendry's third case. The patient was aged 37 and had ten children. Just about full-term she had a slight hæmorrhage. Next day there was no hæmorrhage, but the day after there was slight pain in the left side and the hæmorrhage returned. She did not want to go to hospital as she thought she was

Spontaneous Rupture of the Uterus

not in labour, but a neighbour said she noticed the child "rise in the stomach"—apparently at that time the uterus ruptured. When she was admitted to hospital the os was closed but she had been bleeding a good deal. On examination the head could be felt below the left costal margin and the contracted uterus in the right iliac region. Laparotomy was done. The abdomen was full of blood and there was a tear right across the lower uterine segment extending towards the left uterine cornu. The patient was very collapsed after operation (subtotal hysterectomy). There was no degeneration of the uterine wall on section. There had been practically no pain and the patient was not in labour when the rupture took place.

The President, after congratulating Professor Hendry, on behalf of the Society, upon his appointment to the Muirhead Chair of Obstetrics in Glasgow, thanked him for his interesting paper. He remarked that although this was the third time this session that the subject of rupture of the uterus had been discussed, yet on each occasion different points of clinical interest emerged with emphasis. One of the most notable ~~points in Professor Hendry's cases was the silent nature of the process of rupture.~~ Nowadays one comparatively seldom came across the dramatic type of rupture described in text-books. He thought that this was perhaps due to the fact that in the old days, when this description was first coined, ruptures of the uterus mainly followed general tonic contraction of the uterus. Nowadays that condition was a rare one, and a large and increasing proportion of the ruptures occurred through the scars of previous Cæsarean sections.

Professor Hendry (in reply) admitted that the number of Cæsarean sections performed in Glasgow was very great. On the other hand these cases do not afford much scope for observing the effect of a subsequent pregnancy on the Cæsarean scar, as it has been the practice of many of the surgeons to sterilise the patient at the first operation. The percentage of ruptures in cases which have been observed through a subsequent pregnancy is under the average.

The integrity of Cæsarean scars has been well tested in Professor Ranken Lyle's patient who has had six or seven Cæsarean sections. Another recently reported case has a history of six Cæsarean sections. Professor Hendry practically never sterilises a patient at her first Cæsarean section.

Dr Haultain was quite correct in his remark about the second case—it was the palpation of the uterine wall while the patient was anæsthetised which almost certainly precipitated the rupture.

With regard to the efficiency of the lower uterine segment scar, we must remember that, while this operation is comparatively seldom used

Professor James Hendry

in our own conservative country, it is almost universally practised in America, France, and Germany. The published record of 2600 cases with a history of only 0.28 per cent. of ruptures in a subsequent pregnancy surely establishes the value of this operation.

The case described by Dr Fahmy demonstrates most effectively that the uterus can go well into labour before there is any severe strain on the lower uterine segment.

In the first case reported in this paper, had there not been such imminent danger of rupture, the ideal treatment would have been to wait until it was possible to empty the uterus *per vias naturales* and then at a later date, when involution was complete, to excise a vertical wedge including the septum from the uterus, and stitch the halves together. In a case thus resected by Professor Munro Kerr, the patient went to term with two subsequent pregnancies.

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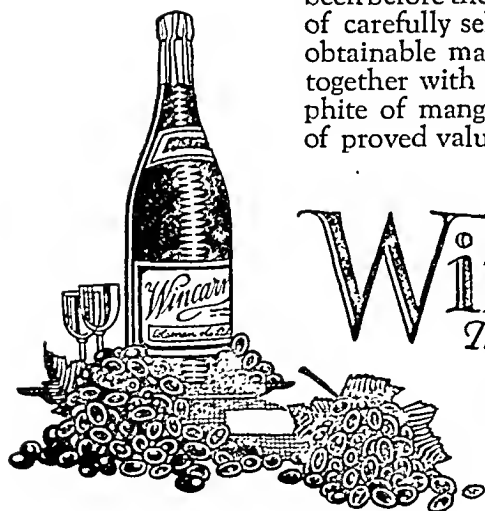
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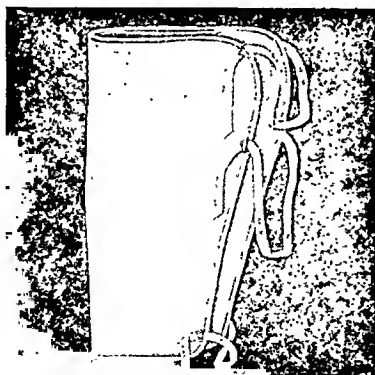
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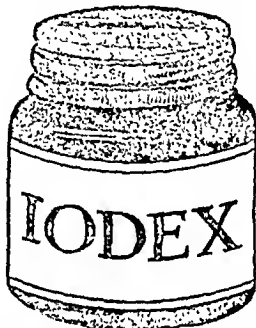
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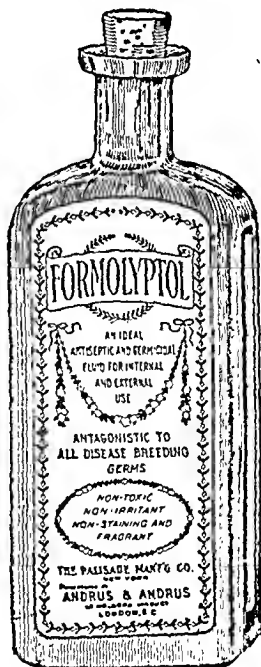
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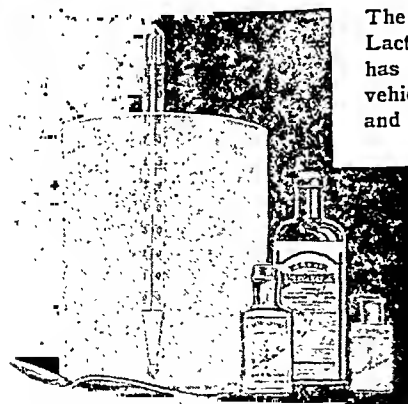
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Edinburgh Medical Journal

November 1927

ABNORMALLY LARGE FORAMINA PARIETALIA.*

By DAVID M. GREIG, C.M., F.R.C.S.E., F.R.S.E., Conservator,
Royal College of Surgeons' Museum, Edinburgh.

ABNORMALLY large parietal foramina are sufficiently rare to make it desirable that every example be reported. Pamperl,³³ writing in 1919, stated that only thirty-six skulls showing this peculiarity had been recorded to date and that the abnormality had been observed only five times during life. From these he has overlooked the case which I described³² in 1917, and this is the more material as the individual was the brother of the man in whom I had first observed this peculiarity in 1889 and published an account of²⁴ in 1892. Abnormally large parietal foramina had not been previously recognised during life and it has nowhere else been recorded as a familial occurrence. Two skulls described by Macieszka²⁹ were unearthed from the same grave in a cathedral along with many other bones. These skulls had an extraordinary similarity, even to the lambdoid sutural bone which was present in each, and may well have been skulls of two members of the same family. There is no reason to suppose that congenitally large parietal foramina should not occur as a familial defect; but Macieszka does not suggest it, and until I published my second case it was not known to occur in more than a single individual in one family. It must be mentioned, however, that in the calvarium of a man who died of pneumonia at the age of 40, both parietal foramina are recorded by Symmers²⁵ as of unusual size. The left foramen measured 21 mm., the right 15 mm. in breadth, and in each the vertical diameter measured 14 mm. The father of this individual "was stated" to have had a similar abnormality. Though uncorroborated hearsay evidence cannot be accounted

* I have to acknowledge gratefully a grant from the Carnegie Universities Trust towards defrayment of the expense of the illustrations of this paper.

proof the statement suggests what is highly probable, the occasional inheritance of this abnormality.

To the radiographers' unfamiliarity with the condition is to be ascribed the absence from their literature of radiograms showing large parietal foramina. During the latter part of the War a friend sent me from a war hospital at Bristol a miniature of a radiogram of the head of a wounded soldier showing large symmetrical rounded deficiencies in the postero-mesial portions of the parietal bones. The wound was not in the head and the discovery was made accidentally in the course of routine examination and its significance was not appreciated. To one who has seen a radiogram of this congenital defect taken during life it was unmistakable. No measurements were available but there could be no doubt as to the nature of the defect. Large parietal foramina give rise to no symptoms, and are generally found by chance at post-mortem examinations or in exhumed skulls.

According to Wrany¹⁴ Bartolinus, probably Thomas Bartolin (1616-1680), declared that abnormally large foramina parietalia of which he had heard rumours did not exist, as no specimen was known in the museums of France or of Germany in his day. Sir Marc Ruffer³⁴ states that the earliest example of a trephined prehistoric skull was found, according to Cartailhac, at Cocherel in 1685 and that it had two perforations. I have not been able to consult Cartailhac's original paper, but the double "trephination" suggests a congenital rather than an operative condition as the more likely explanation.

It is possible that the skull of a full-time foetus figured by Albinus (1697-1770) referred to by Broca²¹ as having an osseous defect in the posterior part of the parietals, may have been an early stage of foraminal enlargement. A similar suggestion may be inferred from the description by Fridolin²³ of a hydrocephalic skull which came under his observation.

A unilateral wide right parietal foramen seems to have been recorded by Lancisi,¹ who referred to the absence of osseous tissue forming a circular hole only obliterated by pericranium. The opening was uniform and polished at its circumference and he considered it congenital. As the parietal foramen is often unpaired there is nothing incongruous in a unilateral enlargement without a representative on the opposite side. Le Double²³ refers to such an asymmetrical arrangement. It is probable that the skull of a woman aged

Abnormally Large Foramina Parietalia

about 70, all too briefly described by Walter,⁴ is an example of this peculiarity. "*In medio osse bregmatis sinistro apertura adest, cujus diameter pollicem æquat.*" This at once suggests the large unilateral foramen mentioned in more modern times by Humphry,³⁵ to which he applies the same criterion of measurement, and this in turn recalls the deficiency in the right parietal in the skull of a girl described by Maggi and quoted by Berry.¹⁰

The descriptions by some of the older writers may be somewhat ambiguous, as that of Bonn² published in 1783, which is as follows: "*cclxxix. Pars superior capitis ossei hominis adulti. Suturae deletæ. Os frontis atque os occipitis crassiora. Os verticis utrumque extenuatum: dextrum media parte depressum et tenuitate foratum: sinistrum media parte tenuiore tuber habet, ora tenuissima circumscriptum, ita ut, procedente tempore facta separatione, foramen dextro simile reliquisset.*" But nearly every specimen has its modern counterpart, and the combination of thinness or flattening with enlarged parietal foramina suggested by Bonn's description has its facsimile in the skull of an ancient Egyptian recorded by Derry,³¹ and perhaps in the skull of an ancient Peruvian which Humphry³⁷ has described where the thinness was more striking apparently than the perforations, of the congenital nature of which he seemed rather doubtful. Obviously some of the older writers lacked personal knowledge of the occurrence, but like Voigtel³ were unwilling to discard the possibility. "*Die Foramina parietalia sind nicht immer da, und bisweilen sind sie ungemein gross.*"

It is a question of relativity. When can the parietal foramina be considered unusually large? If the bilateral, equal, circular perforations with a diameter of only 4 mm. recorded by Arnold³⁰ or foramina the size of a ravenquill as mentioned by Wrány¹⁴ be sufficient to class the foramina as unusually large, anatomical museums should surely yield many more examples than have yet been published. In the most striking examples of enlarged parietal foramina the mere bulk of the opening is the main feature, but where the foramina are smaller their slit-like appearance may be what catches the eye.

In the Museum of the Royal College of Surgeons of Edinburgh there are two skulls in which the foramina parietalia are unusually large. Neither skull has any definite history, and contrary to what usually pertains in this abnormality both

David M. Greig

appear to be skulls of females. Where the sex is known or has been presumed from the cranial characters the ratio between male and female appears to be 10 : 6.

1. A small skull (Fig. 1), probably that of a female, without mandible and of unknown history. It is edentulous but has sockets for the roots of the right 1st and 2nd molar teeth which have been lost. Its measurements are as follows:—

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| Orbital index . . . | 108·82 | ∴ Megaseine. |
| Cranial capacity . . . | 1140 c.c. | ∴ Microcephalic. |

Externally all sutures are present in their entirety except that portion of the coronal between the stephanion and the pterion which is partially obliterated and more so on the left than on the right side. The frontal tuberosities are distinct, the superciliary arches and the glabella poorly developed, and 14 mm. of the anterior extremity of the metopic suture still remain. The nasal septum has a left deviation and there is a cystic development of both middle conchæ. The left half of the nasal aperture is narrower transversely and greater vertically than the right half though the skull is not asymmetrical. There is a slight lateral bulge of the temporal region in the neighbourhood of each stephanion. A shallow post-coronal sulcus is present on the vertex. There are no sutural bones. No absorption has taken place along the spheno-zygomatic suture in either orbit.

Exactly between the parietal foramina the sagittal suture is obliterated for 13 mm. Posterior to this and for 20 mm. anteriorly the suture is linear and sinuous (Fig. 2).

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Around each parietal foramen the outer table slopes smoothly to the circumference. The foramina are oval and somewhat slit-like, their long axes lying horizontally. In each the upper margin is slightly irregular. The left, which is the larger, measures 7 mm. horizontally by 3.5 mm. vertically, the right measures 5 mm. horizontally by 3 mm. vertically. Between each and the line of the sagittal suture but nearer to the mesial borders of the foramina than to the sagittal suture the outer table is perforated by a few irregular openings as from the remains of an interforaminal suture. These perforations constitute a series of minute foramina and irregular fissures which communicate with the diploë and on the right two and on the left two debouch internally, only one transmitting the finest bristle.

Internally the sagittal, coronal, and sphenofrontal sutures are obliterated. A small part of the lambdoid suture at the lambda is still present, the rest is synostosed. The other sutures however are evident. The calvarium is rather thicker in the anterior frontal section than elsewhere, varying throughout between 3 and 7 mm. The inner surface of the pars frontalis shows some irregular osteophytic growth on each side of the sagittal sulcus above and mesial to the frontal tuberosities. There has been some absorption along the venous channels which run upwards on the inner surface of the parietals in close relation but not accurately corresponding to the coronal suture. From the left groove the diploë has disappeared and the bone, consisting only of the outer table, is translucent. Such absorption is described and figured by Coen³⁸ and long before him by Breschet.³⁹

The sagittal sulcus is shallow and is not apparent between the foramina parietalia. The inner table, which is smooth and regular, slopes at the foramina towards their circumference exactly as the outer table does on the superficial surface. From the lateral extremity of each foramen the inner table is grooved by a vascular channel which passes laterally and somewhat anteriorly.

2. The second is a skull from the collection of the late Sir John Struthers, F.R.C.S.E., and is labelled "Negro (Old Calabar)." It is a well-formed adult skull from which the mandible is absent. There is complete maxillary dentition including well-formed third molars. The central and left lateral incisors and the right second premolar have been

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accidentally lost. The teeth are equally and regularly worn and none is carious. The basilar suture is closed. The skull is probably that of a female. Its measurements are as follows:—

| | | |
|-----------------------------------|-----------|-------------------|
| Circumference | 480 mm. | |
| Length | 171 mm. | |
| Breadth (interparietal) | 132 mm. | |
| Cephalic index | 77.19 | ∴ Mesaticephalic. |
| Interzygomatic breadth | 122 mm. | |
| Height | 136 mm. | |
| Altitudinal index | 79.53 | ∴ Hypsocephalic. |
| Basinasal length | 102 mm. | |
| Basi-alveolar length | 106 mm. | |
| Gnathic index | 103.93 | ∴ Prognathic |
| Nasal height | 47 mm. | |
| Nasal width | 28 mm. | |
| Nasal index | 59.57 | ∴ Platyrrhine. |
| Orbital width | 39 mm. | |
| Orbital height | 34 mm. | |
| Orbital index | 87.17 | ∴ Mesoseme. |
| Cranial capacity | 1290 c.c. | ∴ Microcephalic. |

All the cranial and facial sutures are present both externally and internally. The denticulations are large and not firmly locked. The parietal tuberosities are much in evidence. The frontal tuberosities are distinct, the glabella and superciliary arches scarcely discernible. The parietal foramina (Fig. 3) form two circular openings of which the right is the larger and has a mesial offshoot. The outer table of the skull slopes smoothly into the circumference of each foramen. The left foramen measures 4 mm. in diameter and the right 5.5 mm. vertically, and 5 mm. transversely. From the mesial edge of the circumference of the right foramen a horizontal linear suture 3 mm. in length passes into a small almost circular foramen 1 mm. in diameter. Within the skull the inner table slopes to the circumference of the foramina, the smaller of the right foramina opens internally as an oblique slit 5 mm. mesial to the larger foramen.

Dolbeau⁵ in 1854 found in a male subject aged about 50 years, a symmetrical perforation of the posterior part of both parietal bones. The dura adhered to the circumference of the openings, and when stripped off, the perforations were seen to be smaller on the inner than on the outer table. There



FIG. 1.—Norma lateralis dextra, showing small size and low set character of the skull.

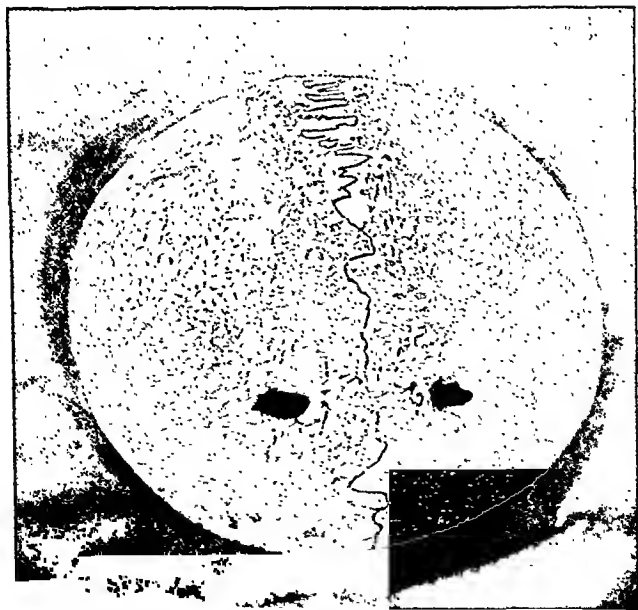


FIG. 2.—Posterior parietal region of the skull depicted in Fig. 1, showing large foramina parietalia.

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was no cicatrix or trace of injury to the skin, and on that account Cruveilhier considered the condition to be an atrophic one, and this specimen to prove that absorption of the bony tissue could involve the whole thickness of the skull. Many of the older writers like Carrière²⁰ and Follin and Duplay¹⁸ were not averse from considering the large openings to be secondary to atrophy, and Sauvage thought it was conducted to by atheroma. This theory has no supporters now.

To Professor Turner, however, belongs the credit of giving the first adequate description of enlarged parietal foramina. This calvarium was obtained in 1865 by MacLagan¹² at the post-mortem examination of a woman aged 25. The parietal deficiencies were not noticed during life, though a tumour the size of a hen's egg, which projected above the occipital pro-

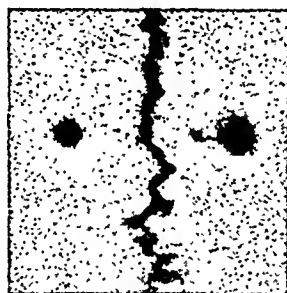


FIG. 3.—Large parietal foramina in a negro skull.

tubérance, must have been examined by several medical men. The tumour was cystic, had existed since childhood, and the skin over it was hairless. Meningitis supervened on the third day after removal of this meningocele, and death resulted two days later. The large parietal foramina were closed by membrane which transmitted, according to Turner,¹³ "numerous small veins." This, Turner says, was borne out by the membranes being cribriform and by the grooving of the inner table at the margins of the openings. The occipital opening was narrowed by membrane round its bony circumference and transmitted the stalk of the meningocele, though no direct connection with the cyst seems to have been observed at the autopsy.

Through the kindness of Professor Robinson I have been permitted to examine and photograph this calvarium of which I submit the following description (Fig. 4):—

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3. The coronal and lambdoid sutures are present both within and without the calvarium. Externally the anterior 40 mm. of the sagittal suture remain. Thence it is synostosed as far as the obelion, and from there its posterior 34 mm. extends to the lambda and is present on both cranial surfaces. From the anterior end of this unobliterated portion of the sagittal suture a linear suture 20 mm. long passes into the enlarged left parietal foramen, involves the whole thickness of the bone, and is as evident internally as externally. From the sagittal suture to the enlarged right parietal foramen there are indications, slight irregularity and grooving, of the former existence of a suture corresponding to that of the left side. From the right limb of the lambdoid suture 12 mm. from the lambda a linear suture, equally obvious on both tables of the skull, runs into the centre of the upper border of the large oval deficiency which is found in the interparietal portion of the occipital bone.

The right parietal opening has its long axis which measures 21 mm. directed transversely with laterally a slight upward inclination. Its vertical diameter is 14 mm. The long axis of the left parietal opening is quite horizontal and measures 18 mm. and its vertical diameter 9 mm. The edges of both these openings are smooth and rounded and are faintly marked with short striæ giving an appearance of puckering. Internally the lower border of the left opening is slightly crenated. The two openings are 34 mm. apart and a few minute vascular foramina open on this part of the skull.

The diploë on the calvarial cut surface is little in evidence.

The opening in the occipital bone lies in the sagittal plane, is oval and measures 25 mm. vertically and 14 mm. transversely (Fig. 5). Its edges are rounded and smooth, and on the inner table (Fig. 6) the lateral edges slightly diverge superiorly to form the margins of a broad shallow groove which passes upwards and is traceable to the circumference of the left parietal perforation. In the middle of the floor of this groove run the suture which connects the left parietal perforation with the sagittal suture, part of the sagittal suture itself, and the suture which passes from the right lambdoidal limb to the occipital perforation. The groove which is broad and shallow may have lodged a sinus and is separated from the sagittal sulcus by a distinct ridge. The sagittal sulcus is considerably narrowed though not appreciably deepened where it lies in

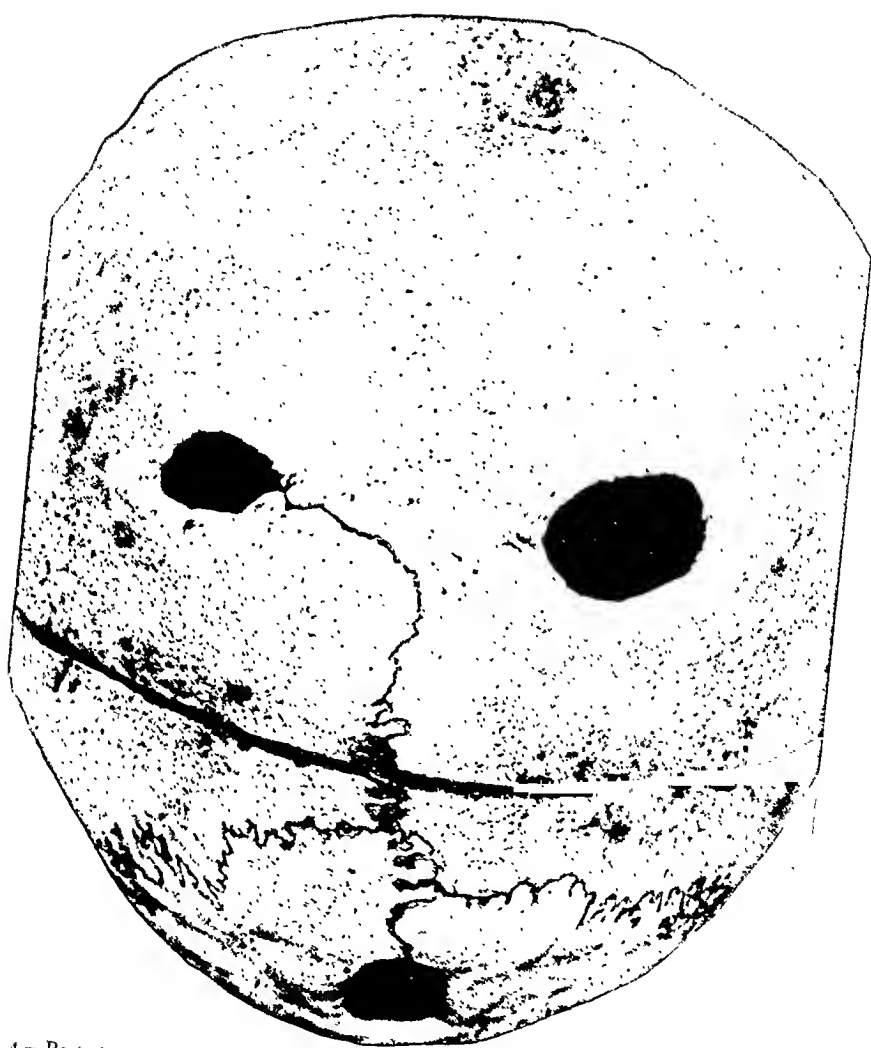


FIG. 4.—Posterior aspect of calvarium from the Anatomical Museum of the University of Edinburgh, showing large parietal foramina and the occipital perforation which transmitted a meningocele.



FIG. 5.—Norma occipitalis of the same skull (Fig. 4) to show the relations and true shape of the occipital perforation.

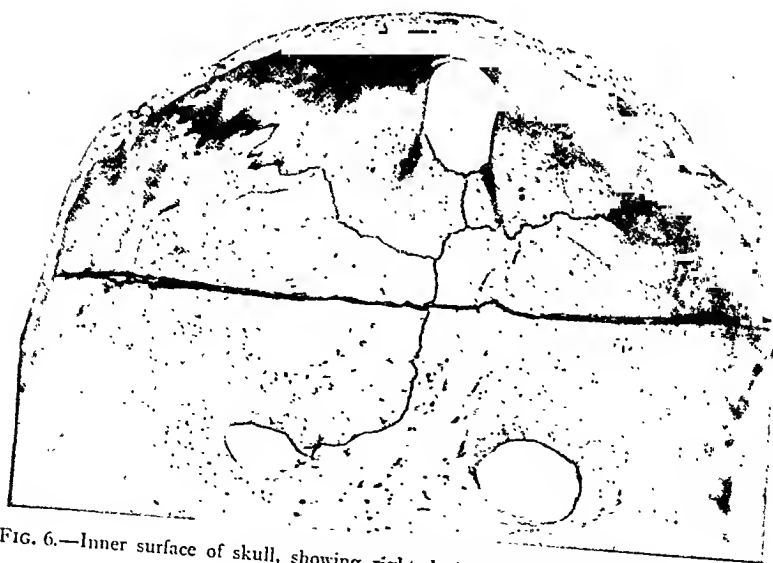


FIG. 6.—Inner surface of skull, showing right deviation of the sagittal sulcus and its continuation to the occipital perforation.

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close approximation with the groove, and unless the sinus itself was narrowed at this part it must have bulged considerably beyond the sulcus. The sagittal sulcus as it approaches the obelion from the front deviates to the right, passes close to the right parietal perforation and is continued close to the right border of the occipital perforation to the torcular.

The two parts of the sagittal suture present externally lie in the sagittal plane, which is not the impression produced in the drawing which illustrates Turner's paper.

The circumference of the calvarium is 520 mm.

A definite pronouncement by so great an authority as Professor Turner inevitably turned the eyes of the anatomical world to this peculiarity and ensured early confirmation. But before passing to that I would briefly record another skull-cap from the Edinburgh University Anatomical Museum which I have been privileged to examine (Fig. 7).

4. The skull has not been a large one. The central 32 mm. of the coronal suture is ankylosed. The anterior 50 mm. of the sagittal suture is obliterated by ankylosis; traces of the suture are then visible over 26 mm. while the posterior 16 mm. is again obliterated. Except at the lambda and a small part on each side (40 mm. on left, 20 mm. on right), the lambdoid suture is still present.

The parietal foramina are oblique slits the long axis directed transversely with laterally a slightly upward direction. The right, which is the larger, measures 16×5 mm., the left 12×3 mm. They are slightly irregular and the lower margin is somewhat crenated. There is a suggestion that the lambdoid suture has formerly communicated with the left foramen. Internally the coronal and sagittal sutures are entirely obliterated, but a portion of each limb of the lambdoid is preserved as a linear impression. The parietal openings are bevelled at the expense of the inner table.

Mesially the adjacent borders of the parietal openings are 32 mm. apart.

The circumference of the skull-cap is 367 mm.

The expectation of other observations following Turner's was quickly realised. Wraný,¹⁴ Gruber,^{15, 22} Simon,^{16, 17} Broca²¹ described the abnormality in eleven skulls within the next decade, Broca including those of Larrey and Chil. In one of Gruber's²² the enlargement was unilateral, the right alone being affected. In 1892 I described the condition in the

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living subject, and since then other examples have gradually been added to the skulls already described. Bourneville and Paul-Boncour²⁷ found large parietal foramina in the skull of an epileptic male congenital imbecile aged 33 years. Reitsema⁴¹ and Di Gaspero⁴² also observed the condition in association with epilepsy, and Pamperl's³³ woman aged 20 had had epileptiform attacks recurring since birth.

The presence of large parietal foramina seems to be frequently associated with a rather small skull, a microcephalic skull as far as its cranial capacity goes, but not with mental deficiency. In the case of an enlarged right parietal foramen in the skull of an ancient Egyptian already referred to, probably



FIG. 7.—Enlarged oblique slit-like foramina parietalia.

that of a female aged about 21 years, Derry³¹ suggests from the unused condition of the teeth from the tartar on their labial surfaces, and from the preservation of the enamel that the individual was mentally deficient. He ascribes the opening to the possible presence of a dermoid or other cyst but both inferences seem somewhat strained. Even with the scapho-microcephalic skull described by Paterson and Lovegrove,²⁶ mental deficiency is not even a probability, and a cranial capacity of 1225 c.c. is not insufficient to maintain an average mentality. An opening in the skull where no opening should be as in the planum occipitale in Turner's case may be *prima facie* evidence of a congenital tumour, but a deficiency at the site of a normal foramen is *prima facie* evidence of congenital largeness. That even large openings in the cranial bones need not be associated with tumour is proved by the curious

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case reported by Smith.¹⁰ In this boy aged $4\frac{6}{12}$ years the deficiencies were found accidentally during examination of an abscess of the scalp. There was no question of craniotabes. The inflammatory condition subsided but the child died some months later from whooping cough. There was found on post-mortem examination a large irregular deficiency in the occipital which encroached beyond the suture into the right parietal (Fig. 8). There was a circular opening 50 mm. in diameter in the right parietal close to the sagittal suture and



FIG. 8.—Congenital calvarial deficiencies in a boy aged $4\frac{6}{12}$ years.

an oval one 50×25 mm. in the anterior part of the left parietal. The margins of these openings were abrupt and well defined though irregular, and the openings bore no relation to the fonticuli. All were closed by a firm fibrous membrane and elsewhere the skull was normally and well ossified.

An opening due to tumour is much more common in the occipital than in either of the parietal bones, and even though the tumour does not protrude the bone over it may be deficient. Ogle^{6, 7} has reported two such occurrences as well as the more common case in which an extracranial expansion of a meningocele existed.¹¹ Even a traumatism may leave a

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permanent opening as is described by Kellock⁴⁵ in a girl aged 14 months. A fall resulted in fracture of the right parietal with the formation of a traumatic cranio-meningocele which underwent spontaneous cure leaving a large permanent hiatus in the bone. Howship⁴⁶ and many others have shown that a meningeal protrusion after injury is not necessary to the formation of a permanent opening, nor is the occurrence confined to childhood.

In the Museum of St Bartholomew's Hospital, London, there is preserved the calvarium of a woman aged 28 years. According to the Catalogue (Ia) there was "no evidence of syphilis." The whole of the inner table is marked by convoluntary impressions and the parietals at the bregma are perforated, the left by one and the right by two irregular openings. The condition suggests a hydrocephalus with intracranial pressure and imperfect ossification or absorption of bone in childhood. The position of the openings excludes the participation of the parietal foramina, but is of interest as showing another variety of parietal perforation.

That the parietal foramina do vary in size, number, and position has been attested by many observers.

A parietal foramen may be so diminutive as to be capable of transmitting only the finest bristle, but only that is to be considered a foramen which communicates with the interior of the cranium, not that which terminates in the diploë. The parietal foramina may be absent; one or both may be double. In three-fifths of the cases, according to Gruber,¹⁵ the foramina are of equal size. Normally at an appreciable distance from the sagittal suture, one or both of the foramina may be displaced mesially until actually in contact with the suture (Fig. 9). Alone (Fig. 10) or in addition to the foramina (Fig. 11) may be a sagittal foramen which opens into the sagittal sulcus and, like the parietal foramina themselves, is subject, though under greater restriction, to variation in size.

In the Museum of the Royal College of Surgeons of Edinburgh, I have examined 670 skulls and calvaria with the following result:—

1. Both parietal foramina present in 306 (45·6 per cent.).
2. Right parietal foramen alone present in 86 (12·9 per cent.).
3. Left parietal foramen alone present in 80 (12 per cent.).

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4. Both parietal foramina absent in 198 (29.5 per cent.).
5. A sagittal foramen alone present in 18.
6. A sagittal foramen with both parietal foramina present in 10.
7. A sagittal foramen present with right parietal foramen in 4.
8. A sagittal foramen present with left parietal foramen in 4.

The parietal foramina were thus represented in 472 (70.29 per cent.) of the skulls and in these the right parietal foramen was double in 7 (1.48 per cent.) and the left in 5 (1 per cent.). A sagittal foramen was present in 36 skulls (5.3 per cent.).

If to these are added the statistics gathered by Le Double,²³ by Paterson and Lovegrove,²⁶ by Maciesza,²⁹ and by Gruber²² a total of 4228 skulls is obtained. In these the parietal foramina were represented by one or both in 62.39 per cent. This does not take into consideration 127 crania in which "vestiges" of both foramina were present, for these I take it were imperforate openings and were therefore not true parietal foramina. There was no trace of a parietal foramen in 32.78 per cent. Paterson and Lovegrove do not mention a sagittal foramen, but excluding their figures it was present in 3.67 per cent. The only other feature of these extended statistics bearing on abnormalities of the parietal foramina is that the left foramen is absent nearly twice as often as the right. Where the foramen or foramina are double they lie horizontally (Fig. 12), that is at right angles to the sagittal suture.

Le Double quotes Ranke that in 50 oranges the parietal foramina were absent in 62 per cent., that in 70 hylobates it was absent in 85 per cent., and that out of 537 skulls of "primitive" races the foramina were absent in 17.3 per cent.

In the examination of the parietal bones of 85 full-term foetuses, Paterson and Lovegrove²⁶ found present in 82.35 per cent. a cleft in the mesial border of each parietal in the position of the parietal foramina, and towards the lateral extremity of this cleft a rounded or oval notch transmitting a blood vessel. In the skull of a female mongolian imbecile aged 16 years, a form of mental deficiency characterised, as I have described elsewhere,⁴⁷ by incompleated development, the parietal foramina were unusually large and connected with the sagittal suture by transverse linear sutures (Fig. 13). Broca,²¹ as Welcker⁹ had

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done before him, pointed out that the foramina were not distinguishable in the new-born and that they were relatively larger in persons past middle-life. He attributes this to the amplification of the emissary veins which as with the whole venous system throughout the body is relatively less in youth



FIG. 9.—Single (right) parietal foramen displaced mesially.



FIG. 10.—Sagittal parietal foramen.



FIG. 11.—Small sagittal foramen associated with parietal foramina.

than in age. Around the sagittal point Broca considered the area imbued with defective vitality and that a fissure, a fonticulus as described by v. Gerdy in 1837, or the parietal foramina were all expressions of the same evolutionary process.

The cause of want of ossification Gruber¹⁵ considered not clear. The presence of arteries and veins he thought not a likely cause as at times small vascular channels are present

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about the margins and these do not participate in the enlargement though they contain blood vessels, and the vascular grooves are not more or larger than those about the normal foramen. According to Hyrtl⁸ each parietal foramen gives exit to the

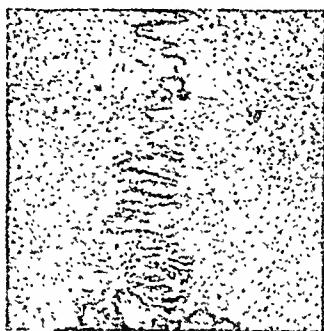


FIG. 12.—Double parietal foramina on both sides.

largest of the rami perforantes of the middle meningeal arteries supplying, in its course through the foramen, branches to the diploë. Its vascular nature is undoubted. Le Double²³ states that the foramen transmits the parietal branch of the occipital artery and a venule arising from the occipital veins or a branch

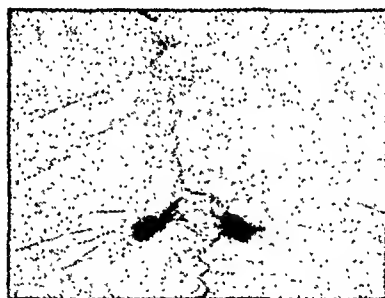


FIG. 13.—Large parietal foramina in a female mongolian imbecile aged 16 years.

communicating with it. Abnormally the foramen is filled with more or less dense cellular tissue which contains only one artery and one vein.

It is difficult to disregard the vascular element in the parietal foramina. Wrany¹⁴ thinks that extreme hyperæmia during the ossification period of the skull and the consequent

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dilatation of the vessels may have something to do with the large size of the foramina, and he maintains that in the skulls presenting the largest parietal foramina there is a degree of marginal hyperostosis. He does not offer any explanation, however, for the extreme hyperæmia. Macieszka²⁹ records that Bialnicki failed to find any vessel perforating the membrane which closed the abnormally large openings. I have been unable to verify this from the original paper but if it is correct it is quite the exception, for almost all authors refer to vessels passing through the foramina in the recent state and to vascular grooving of the inner table at the margins of the foramina in macerated skulls as mentioned by Plenck³⁰ and others. When Schloffer operated on the female epileptic aged 20, whose case is reported by Pamperl,³³ the soft parts were noted as being more adherent over the large parietal foramina than elsewhere, and this seemed to be due to two cords of connective tissue passing from the foramen to the galea aponeurotica. Division of these showed that they contained delicate arterial and venous channels which bled considerably. Histological examination of a portion of the tissue excised showed it to have the structure of the dura mater. Pamperl assumes that the epilepsy was associated with increased intracranial tension, and suggests that the pressure thus brought about may have influenced the ossification of the parietals in the neighbourhood of the foramina. If, however, pressure was a factor it would be exerted on the inner table and if any bevelling occurred it would be of that surface, whereas in reality bevelling is always in congenitally large parietal foramina at the expense of the outer table and very often of both. Broca²¹ attempts to explain the bevelling by assuming an equal rate of ossification of the two tables centrifugally from the parietal tuberosity, that of the superficial layer being the slower. That this occurred specially towards the obelion is evidenced, he thinks, by the presence of the parietal fissure. This fissure is figured by Hofmann⁴⁰ and its bearings considered, and it is its direction which determines the transverse diameter of the abnormal foramina being the larger and the horizontal position of the accessory foramen in duplication.

A leash of vessels with a cribriform membrane might, Turner thought, determine the abnormal size of the foramen, but this is not present in all large parietal foramina. A single vessel, even of abnormal size, an artery and a vein or venæ

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comites could never fill a large foramen. Obviously multiplicity and size of vessels cannot alone explain the enlargement.

"The meningeal vessels," writes Eve,⁴³ "enter the bone at the anterior inferior angle and inferior border and terminate above, being most scanty in the region of the posterior superior angle, *i.e.*, above and posterior to the parietal eminence." Though Eve was writing of what I have described elsewhere⁴⁵ as a localised symmetrical atriopathy of the diploë of the parietal bones, he refers specifically to the enlarged parietal foramina described by Broca, and continues: "Examples of such arrest of ossification would indicate a defective nutrient supply at this point. It would appear that the band of bone running along the margin of the sagittal suture and the other margins is ossified separately from the ossific centre which extends from the parietal eminence. A marginal band of bone, therefore, is formed before the region of the parietal fissure is filled in." Even were this developmentally accurate it does not explain why ossification stops short. It is very questionable if the nutrition of this area of the parietal is ever below that of the rest of the bone. This part of the parietal bone is last to ossify, not because the growth there is defective but because at that part, as at the fonticuli, as long as a possibility of growth remains, a potential activity is retained lest the expanding brain should require it. Delay of ossification here may be not a sign of weakness but evidence of strength, an evidence that should occasion arise the bone can yield a little further. These areas correspond to the cartilages of conjugation and permit of growth under cerebral supervision. Is this disturbance of parietal growth, then, a local condition, or is it part of a general one?

There is not wanting, among examples of large parietal foramina, evidence of disturbance of general body-growth as well as of a local dysplasia. The brothers whom I have described,^{24, 32} and one of whom I demonstrated⁴⁴ before the Medico-Chirurgical Society of Edinburgh, were both under average size though strong and active both mentally and physically. In both the head was small and the facies somewhat Mongolian. The woman described by Pamperl³³ was undersized, and whether among individuals or among skulls large parietal foramina are usually associated with a cranio-metrical microcephaly. That one of the skulls described by Wraný and one of those described by Simon were adjudged

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hydrocephalic in no way invalidates the argument in favour of "central" control of bone-growth. Another of Wraný's skulls was microcephalic as were the three mentioned by Paterson and Lovegrove and that of Paul-Boncour. Both the skulls I have described in this paper were microcephalic. The enlargement of the foramina is secondary to the microcephaly and is not a primary peculiarity.

Locally and generally full development has not been attained, and it seems to me that this is a dysplasia where the local cranial result is but a manifestation of a general disturbance apparently limited to the bones. A single familial or hereditary occurrence of large parietal foramina proves the maldevelopment to be congenital and not dependent on environmental circumstances or individual disturbance of growth. It means a failure of that central combination of control without which completion of foetal and post-natal growth cannot occur.

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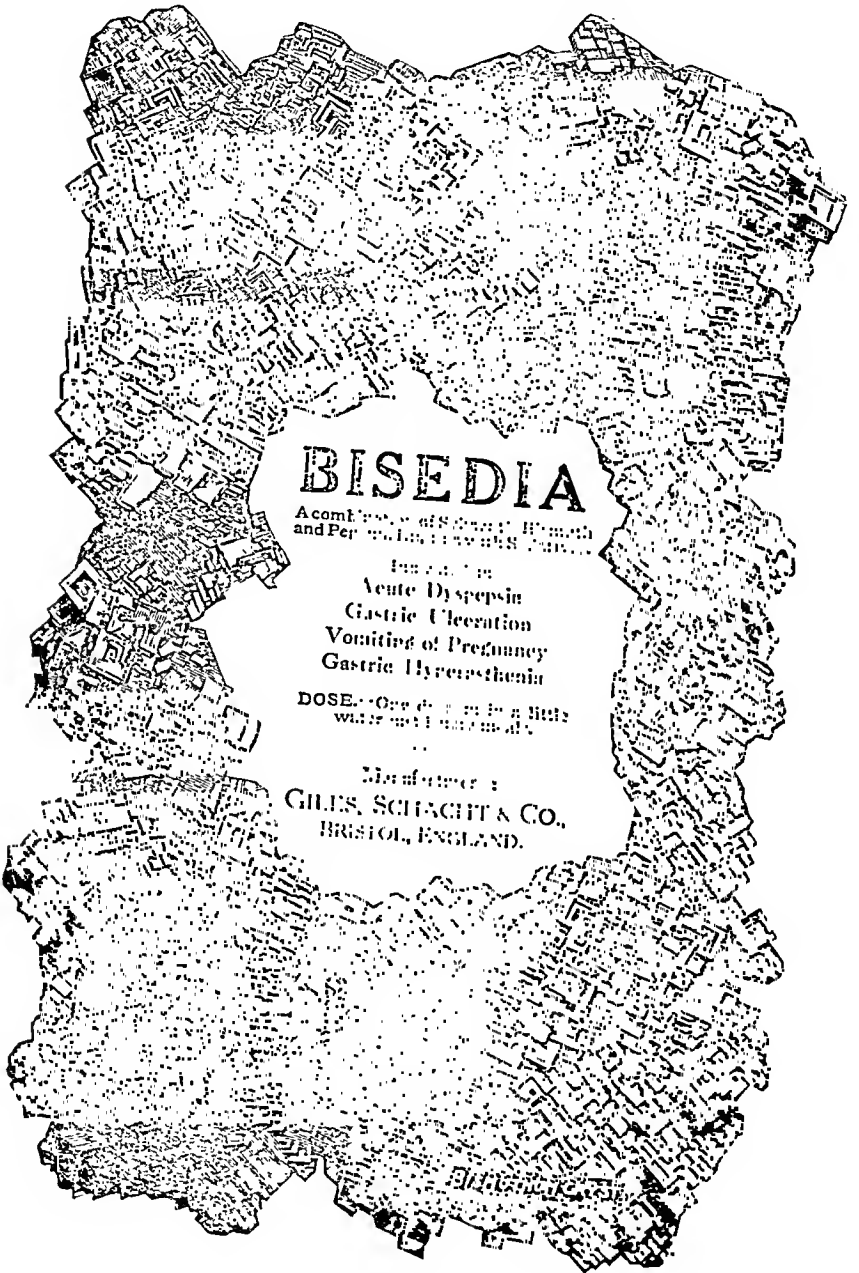
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ANEURISM OF THE CAROTID IN THE CAVERNOUS SINUS.

By W. E. FOGGIE, M.D., F.R.C.P.E., Physician, Dundee Royal
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ANEURISMS of the larger vessels in the cranial cavity occur with moderate frequency, but their clinical recognition is only a thing of rare note. This is, of course, often due to the fact that such aneurisms may show no signs during life, or else it may be due to the anomalous nature of the resulting picture. In certain situations, however, the clinical phenomena are so definite and so distinctive that the localising value may in conjunction with the history lead to the necessity of considering seriously the possibility of aneurism as a diagnosis. Of such a nature is the case that is herewith submitted:—

CASE.—Mrs D., aged 56, was admitted to hospital on 23rd February 1925, on account of ptosis of right eye, severe headache, and vomiting. The ptosis had lasted for four months but the headache and vomiting were only of five weeks' duration.

Her previous health had been good but she had had pneumonia twenty-eight years ago and again seven years ago. She used often to take "bilious attacks," but these had been much less frequent of late.

Family History.—Her father died of heart trouble as did also her brother. Her mother died of pneumonia. Three sisters have died—(1) from disease of the stomach ; (2) after operation for rupture ; and (3) from meningitis. She is married and has had one son who died from meningitis.

Present Illness.—The patient was perfectly well until a month ago, when she began to notice that the upper lid of the right eye was drooping, but as she had no other symptoms at all she paid no special attention to this. The eye was not completely closed. She was suddenly struck five weeks ago with severe pains over the right side of the face and head shortly after getting up in the morning. Her eye became completely closed and she had violent vomiting for two days. After this the symptoms abated slightly but she has never since been free of pain. Sometimes the pain is excruciating and then especially over the right eye. She has been vomiting almost every day since then—sometimes very small quantities and quite unconnected with the taking of food. She cannot sleep because of the pain, which gives her the feeling that her head is going to burst. She has also the feeling of a numbness over the right frontal and parietal regions and of a hyper-

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æsthesia of the right cheek. Her mouth has been very dry and she has had no nasal secretion at all.

Present Condition.—Patient is a healthy looking woman of medium build. She gives a perfectly lucid and intelligent account of her illness and is not in any way mentally confused. She complains of very severe pain over the right side of the forehead and right parietal bone limited to an area between the sagittal suture and a line parallel and 2 inches to the right of it. There is complete ptosis of the right eyelid but no loss of power in any of the other facial muscles—there is a small amount of movement of the right eyelid when she blinks. Wrinkles are present and equal on both sides of the face. There is no deviation of the tongue.

Area of anæsthesia; the medial limit is the mid-line, the posterior limit is the occipito-parietal suture, while the outer limit is a line drawn from the external canthus of the right eye directed backwards and slightly inwards to meet the posterior limit. Anteriorly it is limited by and includes the upper eyelid. The whole of this area is insensitive to deep pressure.

The area of hyperæsthesia is $\frac{1}{2}$ inch around the edge of anæsthesia except on the medial side. It also extends along the right side of the nose and right half of the upper lip and includes the area bounded by the mid-line, the lower orbital margin, and the line joining the outer canthus of the right eye to the right angle of the mouth.

Sensation of the lower lip and lower part of the jaw are quite unimpaired. There is no bruit in the head.

Eyes.—There is complete paralysis of the extrinsic and intrinsic muscle of the right eye. The eye is immobile and fixed in a central position. There is a loss of the corneal reflex and the pupil does not react to light, accommodation, or consensually. The left eye appears normal in all respects to outward examination. The corneal reflex is normal and all the pupillary reflexes are satisfactory. The pupils are regular, and equally and moderately dilated.

Vision—Right: 6/18. Left: 6/12.

The field of vision (for white) is diminished on both sides on the temporal sides, and the total field of vision of the right eye is slightly less than that of the left eye. There is no diplopia. Ophthalmoscopic examination by Dr Angus MacGillivray showed the presence of a slight trace of optic neuritis in the right eye but none in the left.

Smell, taste, and hearing are unaffected.

There are no subjective or objective sensory phenomena beyond those described above. The muscular system generally is good. There is a slight increase in some of the deep reflexes, viz., triceps, biceps, and knee jerk to an equal extent on both sides. Babinski is absent on both sides.

The *other systems* showed little change. The condition of the heart

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was good. The vessels were not palpable. Systolic B.P. was 130. The respiratory system was normal, but the alimentary disclosed a history of bilious attacks at an earlier date. There was also a loss of appetite, constipation, and during the last five weeks more or less constant vomiting after the usual warning symptoms.

Urine.—Sp. gr. 1025, acid, no albumin and no sugar, with deposit of mucus. The Wassermann is definitely negative.

Course of the Disease.—During the first three weeks after admission the patient required morphia daily on account of the severe neuralgia, but thereafter the pains subsided. At the same time pot. iod. gr. 20 and liq. hydrarg. perchlor. min. 30 were given t.i.d. There were no changes in the extent of the motor or sensory paralyses. After six weeks in hospital the patient went home. A report of her condition a year later shows that there is very little change. The ptosis with the other ocular paralyses remain as before. The objective sensory phenomena still exist, and at times the neuralgic pains are in evidence. There has been no recurrence of the vomiting noted before her admission to hospital.

Summary.—A woman of 56 develops a slight ptosis of one eye, and after a few months presents a paralysis of the 3rd, 4th, and 6th nerves of the same eye with, as a consequence, a total ophthalmoplegia (both internal and external). There is in addition a slight optic neuritis in the same eye. Further, there is an involvement of the 5th nerve in part—anæsthesia and neuralgia in the ophthalmic division, and hyperæsthesia in the second division. For the time being the condition appears to be stationary.

The above case represents a clear clinical picture of a condition which though not common is yet now and again met with in patients where at later dates pathological confirmation is forthcoming. The lesion which is certainly intracranial in origin appears to be situated at the base of the brain, but from the wide involvement of nerves and the absence of all the cardinal symptoms of cerebral compression is extracerebral in character.

The complete syndrome represented by the combination of paralyses of the 3rd, 4th, 6th, and the ophthalmic division of the 5th, points to a lesion at the back of the orbit before these nerves pass through the sphenoidal fissure. The site of such a lesion is to be found in the cavernous sinus in its short course of $\frac{3}{4}$ in. backwards from the sphenoidal fissure to the apex of the petrous portion of the temporal.

The lesion then is either in the cavernous sinus or is due to pressure on the sinus. There may be pathological changes

in the sinus itself or in the internal carotid as it passes through the sinus, but in either case there will be pressure effects on the above group of nerves which lie in such close relationship to the walls of the sinus.

The possible causes of such a lesion are:—(1) injury, (2) gumma, (3) tumour, and (4) aneurism. In the above case there is no history of traumatism while the negative Wassermann serves to exclude gumma.

The peculiar onset and the gradual development of the condition have points in common with the history of a cerebral tumour, but the absence of the cardinal symptoms of tumour rather suggests the diagnosis of aneurism which receives definite confirmation from a small but well-marked group of cases which occur scattered through the literature.

As regards the site and the possibility of such a diagnosis Whitnall¹ says:—"Aneurism of the internal carotid has frequently caused paralysis of this nerve (3rd), and an associated involvement of the trochlear, abducent, and the ophthalmic division of the trigeminal would point to the localisation of a lesion in the cavernous sinus" (p. 330). Another anatomist, Stopford,² in speaking of the 3rd nerve has expressed the same view in almost the same terms as the following extract shows:—"Aneurism of the internal carotid has frequently caused paralysis of the 3rd nerve; the position of the two in the cavernous sinus fully explains this, and the associated involvement of the 4th, 6th, and ophthalmic division of the trigeminal makes the localisation usually a simple task." The possibility of diagnosing the presence of aneurisms of the cerebral vessels during the life of the patient has not been seriously considered by many, but of late there has arisen a feeling that in certain stages and in certain sites there is good ground for believing that such a diagnosis is quite feasible. Beadles,³ who has analysed his notes of 555 cases of aneurisms of the larger cerebral arteries, has divided them into four groups: (1) those in which the first indication of a cerebral lesion has been an apoplectic attack due to rupture of the aneurismal sac; (2) those in which a fatal apoplexy has been preceded by symptoms suggesting a cerebral tumour or other cerebral lesion; (3) those in which there have been indications of a cerebral tumour only; and (4) those that gave rise to no symptoms during life, and the aneurism was discovered accidentally after death.

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The present case falls into group 3. Beadles lays stress on the fact that there exists no distinct relation between the size of the aneurism and the group into which it falls. The important thing is that the production of symptoms depends more on the situation of the aneurism than upon its mere size. In speaking of aneurisms of the internal carotid Beadles says:—"An aneurism of the internal carotid in its cavernous portion is of all those we are considering the most likely to give rise to definite symptoms. In my collected series, symptoms occurred in just under 69 per cent. of the cases. We have here symptoms produced by pressure on the several ocular nerves which pass through the sinus and on the ophthalmic division of the 5th cranial nerve" (p. 312).

The knowledge of the occurrence of aneurisms with definite signs has only grown slowly. The clinical recognition of such cases has been in not a few reports due to a careful correlation of the clinical and pathological data. Perhaps the earliest case is that of Romberg⁴ who, in 1853, described the history of a man of 57 who suffered for eighteen years with intense neuralgia of the three divisions of the trigeminal and in whom there was discovered, post-mortem, an aneurism of the internal carotid in the cavernous sinus. A little later Holmes⁵ and Adams⁶ detailed cases with the same pathological condition, but with signs of a more definite character and also more likely to lead to a topical diagnosis. Perhaps the best known case was that of Hutchinson,⁷ who had diagnosed the condition eleven years before the patient's death. A patient of 40 came under observation with a droop of the left upper lid and a paralysis of the 6th nerve, and also a weakening of all the branches of the 3rd. There was also noted a numbness in the skin of the left forehead. Later the paralysis of the 3rd nerve became complete, while the numbness had extended to the top of the head. There was no neuralgia but there was headache. The left pupil was dilated and did not react to accommodation. There was a bruit in the head. The patient died from disease elsewhere, and the post-mortem report showed an aneurism in the artery in the cavernous sinus. Very few reports followed for some time, but by 1884 Bristowe⁸ in his text-book could already say, in speaking of aneurisms of the base of the brain: "An occasional seat is that portion of the internal carotid which lies within the cavernous sinus." In 1919 P. Moeller⁹ gave a fresh case

and analysed five others which he had collected. Occasional case reports have been appearing from time to time, but there has been very little in the way of a review of the symptom complex of this particular aneurism or of the fact that it was so definite as to lead to the possibility of a diagnosis during life. Quite recently this aspect of the subject has received some attention from Symonds¹⁰ and Cushing¹¹ in relation to cases arising in Cushing's neuro-surgical practice.

Personally I have collected and analysed 12 cases of aneurism of the internal carotid in the cavernous sinus in which there was a correlation of the clinical and pathological data. It would be rather tiresome to describe the individual cases, except in so far as they show such a departure from the common symptomatology as to require a special explanation. The case of Hutchinson described above is one of the best examples of the condition, and as an example of the later ones that of Symonds is equally characteristic. Here is his summary: "The actual sequence here was pain in the distribution of the ophthalmic division of the 5th, signs of paresis, and finally paralysis of the 3rd, exophthalmos, diminished visual acuity probably due to pressure upon the right optic nerve, paralysis of the 4th, paralysis of the 6th."

While the clinical phenomena may be shortly summarised as unilateral ophthalmoplegia with added sensory changes in the trigeminal nerve in one or more of its branches, the detailed analysis of these pathologically verified cases is of great interest.

Of these 12 cases the age showed some variety, but no less than 5 were in the 5th decade, 2 in the 4th, and 1 in the 6th. The remaining ages were 16, 26, and 30, while in one it was not stated. There were 6 females and 5 males and in one the sex was not stated. Personally the age and sex seem to me to offer nothing distinctive but rather depend on the causal factors underlying the aneurism, whether it be syphilis, atheroma, vessel defect, or embolism. There was no history of trauma in any of these 12 cases. Visual acuity was diminished in 6 cases, while there was blindness in 3 cases with optic atrophy in 2 of these. In 3 the condition of the optic nerve was not stated.

The 3rd nerve was affected in 11 cases and in one it was not mentioned. The 4th nerve was involved in 10 cases and in 2 there was no detail. The 5th showed anæsthesia in its first division on six occasions. This branch also showed neuralgia seven times and in three of these there was a coincident

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anæsthesia. The second division was represented by 5 cases of anæsthesia, while there were five times on which neuralgia was present. Twice this neuralgia was accompanied by anæsthesia. There was only a solitary case of anæsthesia in the third division, but neuralgia twice occurred alone. The 6th nerve was affected on ten occasions, while the 7th was once paralysed (case of Reinhardt¹²).

In some the pupil was noted as dilated. There was protrusion of the eyeball in the cases of Reinhardt and Symonds, while it occurred periodically in Nettleship's case.¹³ In only one case, that of Hutchinson, was a bruit noticed. Headache was present in 7 cases (Reinhardt, H. Moeller,¹⁴ Adams,⁶ Holmes,⁵ Rosenstein and Chenzinsky,¹⁵ Viets,¹⁶ and Hutchinson).

The duration of the disease varied within very wide limits. Two cases, those of Nettleship and Romberg, lasted for eighteen years, H. Moeller's for fifteen years, one for eleven years, one for ten years, two for eight years, while the remainder for much shorter periods. Thus two were limited to about one year, and others could be measured by months or even days.

The cause of death was related to the aneurism in 7 cases, of which 5, those of Czermak,¹⁷ H. Moeller,¹⁴ P. Moeller,⁹ Rosenstein and Chenzinsky,¹⁵ and Symonds¹⁰ were due to intracranial rupture. Of the other 2, that of Nettleship was secondary to hæmorrhage into the naso-pharynx, and that of Reinhardt apparently followed enucleation with palpation of the aneurism. In Hutchinson's case an aneurism of the abdominal aorta was responsible for death. In three cases the death was due to general causes, while in one, the patient in Veit's case,¹⁶ died suddenly one year after the case had been diagnosed by operation.

As an example of the case of purely traumatic origin may be mentioned that of Hirschfeld,¹⁸ where a woman of 72 four weeks after an injury showed suddenly ptosis and ophthalmoplegia with anæsthesia over the area of the first division of the 5th. The post-mortem report disclosed a swelling of the dura mater covering the sinus cavernosus. After removal of the clot an aneurism of the internal carotid was exposed.

Two cases very like the above series have been described by Long and Egger¹⁹ and Morton,²⁰ but I have excluded them from consideration as the pathological reports seemed rather to point to changes in the sinus with little in the artery.

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Of course the resulting clinical phenomena were very similar in view of the limited space into which sinus and artery are packed. Cases with purely clinical diagnosis are not common and are naturally open to suspicion. Mello²¹ has described the case of a woman of 60 who had suffered for five years from a unilateral paralysis of the 3rd, 4th, 5th, and 6th cranial nerves which he believed to be due to an aneurism of the internal carotid in the cavernous sinus. There was a history of acquired syphilis. Fisher²² has recently put forward as another example the case of a woman of 59 who was giddy and became unconscious for four to five hours. On recovery she had pain in the right forehead and her eye became prominent. The lid drooped and ptosis was soon complete. There was some puffiness of the lid and distension of veins. A bruit with thrill developed and the right eye pulsated. There was no light reflex. There was a complete external ophthalmoplegia with only the escape of the superior oblique. This case is rather suggestive of a fracture, as the author himself half admits. Lastly Cushing¹¹ mentions the curious case of a man of 54 with complete one-sided ophthalmoplegia with ptosis and immobile pupil who recovered from this condition which, though at first diagnosed as ophthalmoplegic migraine (basilar syphilis?), may have been a small rupture of an aneurism. My own case which is described above is left to speak for itself.

Lastly, it should be noted that tumours (aneurismal or otherwise) though not situated within the cavernous sinus may exercise pressure on the sinus and so give rise to symptoms bearing a resemblance to those due to a lesion within the sinus. Fearnside²³ in his review of cranial aneurisms mentions several pointing in this direction. Thus he says:—"In case 26 proptosis of the left eyebrow together with fixity of the pupil was observed, a mass of blood-clot was found at the autopsy pressing upon the left cavernous sinus; this had escaped from an aneurism at the junction of the left intracranial carotid and the posterior communicating artery."

In the above note the diagnosis of the later stages of the condition has not been trenchd upon. Some of the cases here described may themselves have run a latent course until a partial stretching of the vessel wall brought them within the reach of clinical recognition and permitted of a topical diagnosis. There is, however, with the occurrence of hæmorrhage into the sub-arachnoid the possibility of determining the actual lesion

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as an aneurism by means of various additional clinical signs as well as by the discovery of blood in the cerebrospinal fluid.

What has been specially stressed in this communication has been the need for the consideration of the possible diagnosis of an aneurism whenever there is present a symptom-complex consisting of a paralysis or even a paresis of the 3rd, 4th, and 6th nerves in association with an involvement of the first and possibly the second division of the 5th nerve. This symptom-complex gives the definite localising value, but the nature of the lesion must depend on the due evaluation of the other competing claims in a differential diagnosis.

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THE COMPARATIVE ANATOMY AND DEVELOPMENT OF THE HEART AND OF THE ALIMENTARY CANAL.*

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I WOULD first express to the Council my very warm appreciation of the honour of being invited by them to deliver in this College the Sir John Struthers Lecture on Anatomy. I value it the more since I had myself the privilege of knowing Sir John Struthers personally in his capacity as President of the College, and as an anatomist, and greatly valued his friendship. His contributions to Anatomy were numerous and valued. He had that love for Anatomy which has always been the inspiration to its worthiest workers, and to him the investigation of the structure of the bodies of men and of other living creatures afforded a rich and satisfying field in which to carry out his life's work. The foundation of this lectureship is the final tribute which he offered to the object for which he lived, the mother science, Anatomy.

Subject.—Within the terms of the regulations attached to the bequest, a wide choice of subjects is open to the lecturer, and after some consideration I decided to put before you some work upon which I have recently been engaged in, Comparative Anatomy and Embryology. This work has for its aim the further elucidation of the structure of the adult human heart, and of the alimentary canal, and turns to comparative anatomy and embryology for information and direction.

The somewhat comprehensive title of the lecture indicates only the general nature of the subject which I propose to discuss, for it would of course be impossible in one lecture to deal even in outline with so enormous a subject as the development and the comparative anatomy of the heart and the alimentary canal.

Probably no branch of anatomy has made greater advance since Sir John Struthers' time than that of human embryology. At the same time, it is probably correct to say that the most startling anatomical discovery of recent years is that of the conducting or genetic system of the heart and of the S.A.

* The Sir John Struthers Lecture on Anatomy.

The Heart and the Alimentary Canal

node of Keith and Flack with the revolution which these discoveries have produced in our views of the mechanism of the heart-beat, and the evidence which they afforded us of the existence of an entirely new sort of structure which is the medium of an unsuspected functional activity.

The subject which was specially being investigated was the conducting or genetic system of the heart, but during the progress of the investigation, many and wider questions arose, one of which proved specially attractive, and I may indicate it here.

It is not sufficient to be able to say of an adult organ merely that this is its structure, nor while dealing with its function, to say that such or such in the adult is its function. A full knowledge requires that we know how the organ has developed in the individual and also what is its comparative history in the vertebrates.

It is known that the heart of the developing human embryo shows a general resemblance to the heart of some of the lower forms of vertebrate life,—in other words, that in this organ the embryo appears to recapitulate the evolutionary history of its ancestors.

Should a critical survey show that a close degree of resemblance exists between the comparative anatomy and the ontogeny of the heart, it should be reasonable to inquire whether another system of organs, such as the alimentary canal, shows the same resemblance, and if not, why not?

These are some of the questions which I put before you, and on which I propose to show you the results of the investigations. In the different Orders of the Vertebrates we find a great variety of forms of hearts, from the simple tubular heart of the fish to the compound right and left hearts of the birds and mammals. Of these various forms it may be said that the kind of heart which an animal possesses depends upon the kind of life it leads, and particularly upon the nature of its respiration. In all the forms one finds adaptation to the surrounding conditions, and a high degree of specialisation. The hearts of some of what we are accustomed to call lower forms, and particularly of amphibia and reptiles, are so specialised in their structure that one cannot regard them as in all respects intermediate forms between the fish and the mammalian heart.

But by examining the hearts in these lower and earlier

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forms of evolution, it should be possible to gain some insight into the nature and the significance of structures which are found in a complex form in the hearts of the later evolutionary forms.

Let me first shortly recall to you what the more recent views are of the functional anatomy of the mammalian heart. In the groove on the outer surface of the right auricle which we call the "sulcus terminalis," Keith and Flack discovered a



FIG. 1.—Dissection of the outer surface of the right auricle of an ox heart, showing the sinu-atrial node.

A=Sulcus terminalis, above the plexiform tissue of the node.

B=Appendix of right auricle.

C=Coronary sulcus.

D=Lower part of right auricle.

knot of tissue of peculiar structure, not muscle and not nerve, termed the sinu-atrial node of the heart.

The physiological researches of Lewis have shown the importance of this node, for he demonstrated that its rhythmical activity determines the rate of the cardiac contractions, and to it he has given the name of the pacemaker of the heart.

In addition to this node, there is the "genetic" or conducting system in the heart, consisting of a mass of nodal tissue, the A.-V. node, lying in the wall of the right auricle close to the mouth of the coronary sinus, from which there arises the A.-V. bundle, a strand of tissue of a different kind, termed Purkinje

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tissue, which passes to the walls of the right and left ventricles in two bands, whose function it is to convey to the muscle wall of the ventricle the impulse necessary to produce a co-ordinated and effective contraction of the ventricles.

These structures which for so many years were unknown can now be displayed to the naked eye in the heart of the larger mammals and especially that of the ox.

The illustration (Fig. 1) shows a dissection of the sulcus



FIG. 2.—Auricle of the heart of shark, opened by reflection downwards of the dorsal wall, and viewed from the dorsal aspect.

A=Muscular network on internal wall.

B=below (in natural position above) the sinu-atrial opening, with the right and left venous valves.

C=above the auriculo-ventricular opening.

terminalis in the heart of the ox, in which a network of fine pale tissue is exposed lying under the epicardium, which is the S.A. node. The A.-V. bundle is better known and need not be here specially described.

It has long been recognised that in the heart of fishes a series of chambers can be recognised, termed sinus venosus, auricle, ventricle and bulbus cordis, and their structure and arrangement are clearly shown in the heart of the shark. The specimen shown is from a shark about ten feet long which I dissected recently. The sinus is a small chamber, lying behind the auricle. It receives all the veins from the body

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generally. In addition to the great veins, the coronary sinus, returning the blood from the heart, opens into the sinus independently of the other veins, in the front part close to the attachment of the left venous valve. The wall is thin. It contains little muscle, but is composed largely of connective tissue. The internal surface is reticulated.

On the dorsal wall a prominent vertical band, mainly composed of connective tissue, passes down to the sinu-atrial opening. The nerves of the heart find their first termination in the region of the sinus.

The sinus opens into the auricle by a narrow slit-like opening, lying vertically and not transversely as is the case in some forms, the margins of the slit are formed by two loose flaps, the right and left venous valves (Fig. 2).

These are thin, slightly roughened at their margin, smooth on each surface. Sections show that the structure of the two surfaces is different. The surface towards the auricle has numerous vertical strands of muscle tissue, while that towards the sinus is in smaller and finer bundles.

The base of the valve contains blood-vessels of some size.

Atrium.—The atrium is a large single chamber, triangular in form, measuring in this specimen five inches in height and three in width (Fig. 2).

The inlet from the sinus is on the dorsal wall and the outlet to the ventricle in the lower left ventral angle. The tissue is pale brown in colour, and the muscle coat is unusually thick and complex for an auricle. The internal surface is raised in a complicated pattern of bundles of muscle running in different directions.

Some very distinct bands are seen about the sinu-atrial opening. Attached to the upper end of the valves a thick rounded band runs transversely, and from the lower end oblique bands run downwards and to the side.

The single A.-V. opening into the ventricle measures about an inch in diameter. Its lumen is a narrow slit between two large and fibrous valve cusps, one ventral, the other dorsal, while at the margins between them there are small cusps, so that the slit is H-shaped.

The cusps are anchored to the interior of the ventricle by tendinous cords as in the mammalian heart.

Ventricle. (Fig. 3).—The single ventricle is by far the largest of the chambers. It is roughly four-sided in shape,

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the angles above and below and on each side, and it measures four and a half inches vertically by the same in the transverse axis. The cavity, however, is small, for the wall is thick, measuring an inch and a quarter at the apex, and tapering gradually to a quarter of an inch at the outlet to the bulbus cordis.

The shape of the chamber recalls that often found in the ventricular part of the heart. There is an inlet portion and an outlet one, not in line with one another but set at an angle, so that the lumen is V-shaped, and the inlet at the upper and left angle is separated from the outlet by a rounded raised band of muscle. The muscle coat is curiously spongy and loose in texture, composed of fine bands of muscle forming a close network, and fluid can be squeezed out by a little pressure. The cortical layer of muscle is more compact.

Bulbus Cordis. (Fig. 3).—Little need be said about this portion of the heart. It is a short tubular channel one and a half inches in length and about an inch in diameter. A section of the wall shows very clearly that it belongs to the heart and not the aorta, for the outer layer of the wall consists of brown muscle tissue continuous with the muscle tissue of the ventricle and ceasing abruptly at the junction with the aorta distally.

The interior is characteristic, for there are present the well-known rows of valves. In the present specimen a large distal and a rather smaller row of proximal valves is present with a set of much smaller and less perfectly formed valves between. Three cusps are present in each row. Each of the cusps forms with the wall a deep pocket. The cusps are thick and fleshy, but not muscular, with a thick ridge running vertically from the base to the centre of the free margin, which represents the small corpus Arantii in the aortic and pulmonary valves of man.

The endocardial lining of the whole of this portion is thick and opaque.

Blood Supply to this Heart.—The blood supply to this large and active organ is provided by two sets of coronary arteries from the gill arches. There is a large vessel on the ventral and a still larger on the dorsal surface first of the aorta and of the bulbus cordis, giving off branches to the bulbus.

Above the ventricle these vessels divide and form an arterial circle at the bulbo-ventricular junction from which

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vessels pass on the ventral surface to the ventricle, and on the dorsal surface to the auriculo-ventricular junction and to the auricle and ventricle.

The question arises whether the muscle substance of the heart is nourished by the blood in the interior, but it must be remembered that the blood circulating in the heart is venous and presumably cannot provide the necessary oxygen.

The Conducting Mechanism.—A section across the A.-V.



FIG. 3.—Heart of shark, ventral surface. The ventricle and the bulbus cordis have been opened.

A=Spongy muscle tissue of the wall of the ventricle.

B=Outlet of ventricle to bulbus.

C=Wall of bulbus, the dark coloured tissue to the side is the muscle tissue of the wall which is continuous with that of the ventricle, and ceases abruptly above at the junction with the aorta.

junction shows, even to the naked eye, that there is direct continuity of the muscle tissue of the auricle with that of the ventricle. The figure shows how this occurs (Fig. 4).

The muscle tissue of the auricle is continued on beyond the base of the A.-V. valve cusp, separated for some distance from the ventricular muscle by an infolding of the connective tissue at the coronary sulcus. This connective tissue stops, and the auricular muscle comes into contact with, and its fibres blend with the fibres of, the ventricular muscle. This continuity of muscle tissue affords a continuous path by which the impulse

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for contraction may pass directly from the auricle to the ventricle. No special bundle tissue is required, for there is a single auricle and a single ventricle, and the contraction of the one chamber is followed by that of the succeeding one.

Mechanism of the Heart-Beat.—The heart-beat has been observed to be of the nature of a continuous wave of contraction, which begins in the sinus venosus and spreads thence to the

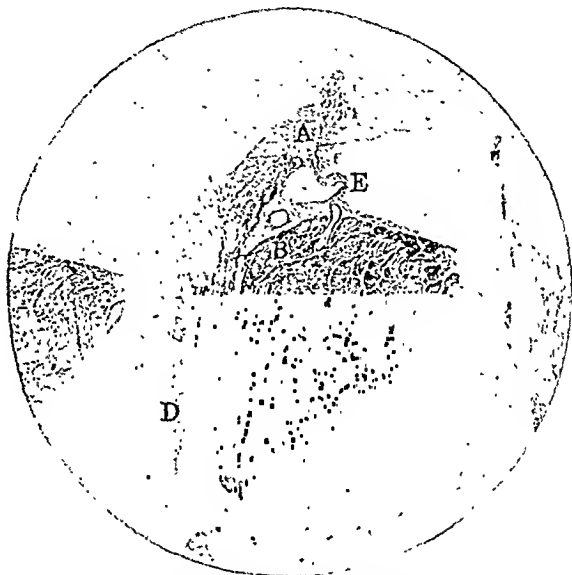


FIG. 4.—Section of the A.-V. junction of the shark's heart, to show the nature of the continuity of the muscle of auricle and ventricle.

A=Muscle wall of auricle.

B=Muscle wall of ventricle.

C=Strand of the muscle of auricle continued below the level of the coronary sulcus (E) becoming continuous with the ventricular muscle at the level of D.

D=Portion of a cusp of the A.-V. valve.

E=Coronary sulcus with the coronary vessels.

auricle, on to the ventricle and to the bulbus cordis. Where the impulse for contraction originates is not known, but I have observed that when the contractions of the surviving heart of the fish are becoming slow and ceasing, the rate of contraction can be accelerated, or contraction elicited anew by mechanical stimulation of the region of the bulbus cordis.

Similar stimulation of the wall of the auricle or ventricle fails to produce this effect, but I noticed that scratching with a pin the bulbus set the heart going again, the contraction

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beginning at the sinus end and spreading onwards in the usual manner.

I do not propose to describe in full the structure of the amphibian and the reptilian heart. In the former the auricle is divided into two chambers, while the ventricle is single, and in the latter, both the auricles and the ventricles are divided into two chambers, right and left.

Heart of the Bird.—The heart of the bird is similar to the mammalian heart since it presents the same four chambers completely separated from one another.

It is needless to describe again all the anatomical features, many of which are well known.

The principal interest attaches to the presence in the right side of the heart of a large valve cusp in the place of the tricuspid valve, and particularly to the fact that this valve is composed of muscular tissue.

Valves of the Turkey's Heart.—Right A.-V. Valve. There is a large muscular cusp, extending round the right and the anterior sides of the opening.

The ventral end of the cusp is short, and is attached to a slight supraventricular crest near the root of the infundibulum. The dorsal end of the cusp is long, and is attached to the septal wall of the ventricle in the angle between the marginal and the septal walls.

The lower edge of this cusp hangs down into the cavity of the ventricle, and is free except at one point where a few millimetres from the anterior end a narrow band of muscle passes from the lower margin to the marginal wall of the ventricle.

A second smaller cusp can be detected, lying between the large cusp and the septum of the ventricles. Its ventral edge is attached to the large cusp, where it blends with the wall, the dorsal edge is attached to the septal wall.

The left A.-V. opening has a *two-cusped* mitral valve, each cusp a large fibrous flap, the aortic cusp larger than the marginal, with chordæ tendineæ and rudimentary papillary muscles. This is the condition in the heart of both the turkey and the goose, and shows that the description often given of a three-cusped valve in this situation is erroneous, as is also the usual statement that on the right side of the heart there is a single flap, muscular in character, while there are really two such cusps, a large and a small.

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The existence of a "conducting system" in the bird's heart has been denied by Mackenzie and Robertson.

It seemed possible that the presence of the muscular valve might afford an explanation of its absence and that the tissue of the valve might itself form the pathway for the passage of the impulse for contraction. The muscle of the auricle as well as that of the ventricle might be present in the valve and so form an unbroken pathway.

I therefore approached this problem with a good deal of interest. While studying this problem, my former pupil and demonstrator of anatomy under Professor Arthur Robinson, Professor Drennan of the University of Cape Town, published a short account of the presence of a bundle of His in the heart of the ostrich, in which he claims to have found a structure of such size as to be demonstrable to the naked eye. I was unable at this time to obtain specimens of the heart of the ostrich in time to corroborate his findings, but I have examined several specimens of large avian hearts from the turkey and the goose. On opening the ventricles one can at once see some structures which to the human anatomist suggest very strongly the existence of a conducting system entirely comparable to that found in the heart of the mammals.

In the right ventricle, for instance, there is a bundle of tissue resembling the "moderator band" connecting the septal wall to the lateral wall of the right ventricle, and as one carries out the separation of these walls from one another there are found numerous fine bundles passing between them. The moderator band of the human heart is not a band which can limit the distension of the right ventricle, as used to be supposed, but acts as a pathway for the passage of the right limb of the bundle of His, and its presence in the avian here was inexplicable for any other function. Sections so far have failed to demonstrate in it any peculiar tissue, such as Purkinje tissue, and the tissue forming it is indistinguishable from muscle tissue. Similarly in the interior of the left ventricle a network of fine pale threads crosses the cavity near the apex, passing from the septum to the marginal wall, and resembling that fine network in the left ventricle of the human heart which is the medium for conveying to their destination in the left ventricle the terminal fibres of the bundle of His.

What, then, is the condition of the muscle cusp at the right atrio-ventricular opening?

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The cusp is thick and fleshy, extends round the whole of the right side of the orifice, and projects for a considerable distance into the cavity of the right ventricle.

A section through the valve and the adjacent walls of the auricle and ventricle show an interesting arrangement (Fig. 5). The fleshy valve is an infolding of the muscle wall of the ventricle. With the wall it forms an inverted J. The auricle muscle thins away as it nears the A.-V. junction, and is continued into the endocardial and subendocardial connective

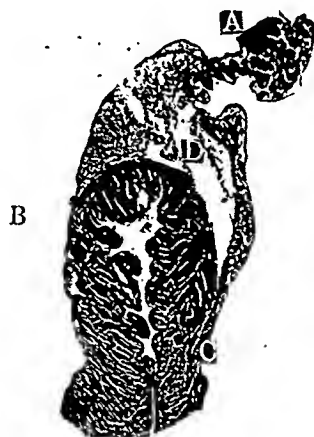


FIG. 5.—Section of the A.-V. junction of the heart of the bird (turkey).

A=Muscular wall of the auricle.

B=Lateral muscular wall of the right ventricle, bent over above to form the muscular cusp of the right A.N.V. valve.

C=Junction of the auricular and ventricular walls, by a strand of the auricular muscle, which is muscular in the upper part and fibrous in the lower.

D=Connective tissue of the coronary sulcus.

tissues alone, and there is no direct continuity of the muscle of the auricle and ventricle.

Structure of the network of Fibres in the Bird's Heart.—Sections of the fine network show that its fibres consist of a covering of endothelium lying on a loose connective tissue layer. Deep to this is a core, consisting largely of convoluted and much folded fibres, staining bright red with Van Gieson stain. With these are some fibres of a brownish colour, not muscular in character. In many parts the appearance is produced that these fibres had been lying in definite spaces in the core.

Heart of the Human Embryo.—The study of the developing

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heart is of special interest, for we have to deal with an organ which is unique in that it begins to function at an early phase of its development, and, while it is still discharging its function of maintaining the circulation, passes through an extraordinary series of changes in its structure before it acquires

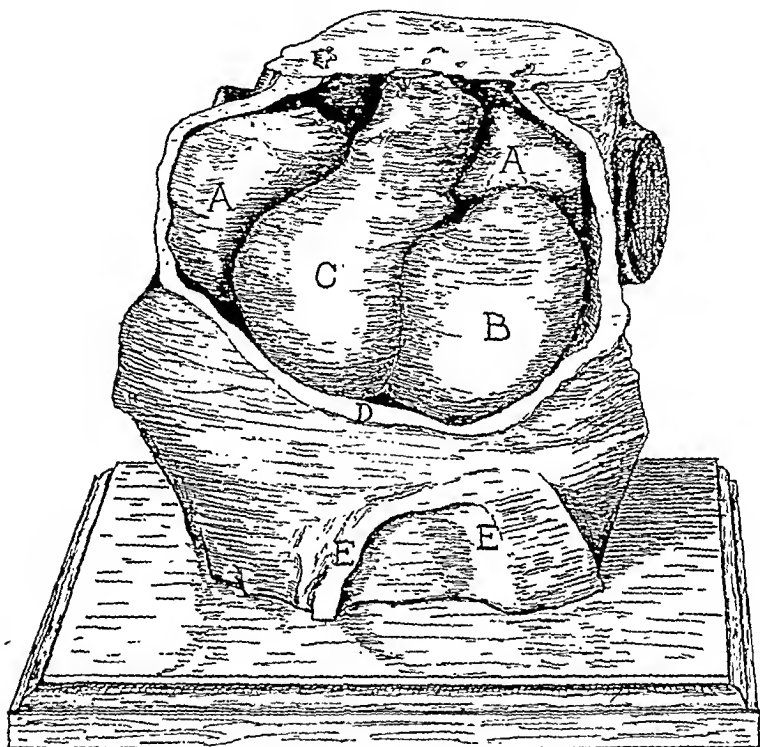


FIG. 6.—Reconstruction of the heart of a human embryo, 8 mm. long.

- A=Tips of the auricular appendages.
- B=Primitive left ventricle.
- C=Right ventricle.
- D=Pericardium.
- E=Root of the umbilical cord.

the characteristic form with which we are familiar in the human adult.

At first it is independent of nerve control, for the necessary nerve connections are not as yet laid down, but yet its various parts work as a co-ordinated whole.

Human Embryonic Heart.—The heart of the young human embryo is in many ways similar to that of the shark. In it

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can be recognised a similar series of chambers, arranged consecutively, sinus, auricle, ventricle and bulbus cordis. The relative position and size of these chambers is not identical,

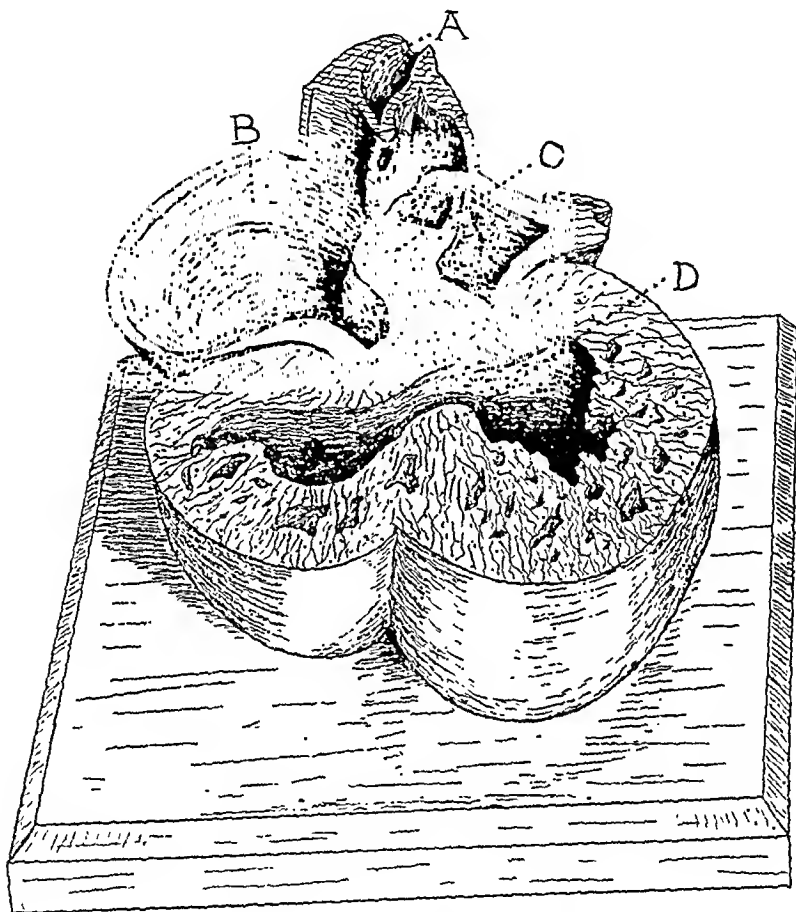


FIG. 7.—Section of the model shown in Fig. 6.

- A=Sinus venosus, opening into the auricle by a narrow orifice between the right and left venous valves.
- B=Right portion of the auricle.
- C=Root of the septum of the auricle.
- D=Muscular septum of the ventricle.

nor is there the same valvular apparatus at the A.-V. opening (Fig. 7).

At first the sinus venosus lies dorsally and to the right side, separated from the auricle by a deep constriction, and the orifice is slit-like, vertical, and bounded on each side by a fold, the right and left venous valves.

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The single auricle lies between the sinus and the ventricle, is large, and opens by a single aperture into the ventricle. There are no valves whatsoever at this orifice, and in this it is strikingly different from the heart of the fish. There is, however, an arrangement which may perform a valvular function, a cushion-like arrangement of subendocardial connective tissue, forming two cushions, upper and lower.

The large single ventricle forms the apical portion of the whole heart, as in the fish, and leads on to another chamber, into which it opens by an orifice slightly constricted. This succeeding chamber we can identify as the *bulbus cordis*.

Its walls are composed of muscle tissue similar to that of the ventricle, and this muscle coat ceases abruptly, as in the fish, at the junction with the *truncus arteriosus*.

There are here also no valves, however, but an arrangement of thickened subendocardial tissue similar to that found in the atrio-ventricular junction, forming the bulbar cushions. The *bulbus* occupies a position in relation to the ventricle different from the shark. It lies at first horizontally and later comes to lie vertically by the right side of the ventricle. There is muscular continuity between the various chambers, and the mechanism for its contraction is the same as in the venous heart of the fish, by continuity of the muscle of one chamber with that of the succeeding one.

I do not propose to describe at length the changes by which the tubular heart is transformed into the four-chambered and two-sided adult organ, but I shall merely indicate some of the alterations.

The *sinus venosus* becomes incorporated into the right auricle. It is, as it were, swallowed up by that chamber. The single auricle becomes divided by a septum into right and left parts, the right one alone retaining its association with the *sinus venosus*, and the left one is fed by the new formed pulmonary veins which grow out from it as the lungs develop.

The ventricle and the *bulbus cordis* become divided into the right and the left ventricles, portions of each of these chambers being present in each of the final ventricles. A portion of the *bulbus* forms the *infundibulum* of the right ventricle. This part, like the *bulbus* from which it sprang, is for a time narrow and tubular, but with the development of the pulmonary circulation, it dilates.

Failure to do so forms one of the commonest of the congenital malformations of the heart, usually termed congenital stenosis of the pulmonary artery.

Several of the specimens in the museum of the College are illustrations of this form of defect. There is, however, another process at work which produces an important effect.

At the A.-V. junction there was a continuity of the auricular and the ventricular muscle, but with the formation of the ventricular septum the band of muscle at the junction breaks down and is replaced by fibrous tissue. No channel is left for the passage of the impulse for contraction from the auricle to the ventricle.

The necessity for a new means of conduction is clear.

The heart of the adult beats with a synchronous contraction of the two ventricles. The impulse must reach the two chambers at the same moment. The portion from which the left ventricle is derived lay originally proximal to that from which the right ventricle takes its origin, and in the early arrangement the left ventricle contracted before the right.

In the adult heart the two ventricles, however, beat synchronously, and the A.-V. bundle provides the means by which this is effected. Evidence of the formation of this bundle can be found at an early stage of development. It appears before the two ventricles are completely separated from one another by the interventricular septum, and is fully formed by the time when that septum is complete.

Anatomical structure is determined largely by functional requirements, and there appears to be little doubt that the formation of the A.-V. bundle has occurred in response to the need for securing a simultaneous contraction of the right and left ventricles, occurring at a definite though short interval after the completion of the contraction of the muscles.

Alimentary Canal.—While a general comparison of the heart of the human embryo with that of the fish has been often instituted, much less attention has been given to a comparison of the alimentary tract, in the one with the primitive intestine in the other.

In the shark one finds a short, widely dilatable œsophagus, with the mucous membrane arranged in large longitudinal folds. The muscular coat is of moderate thickness, and the circular fibres are definitely thickened just above the junction

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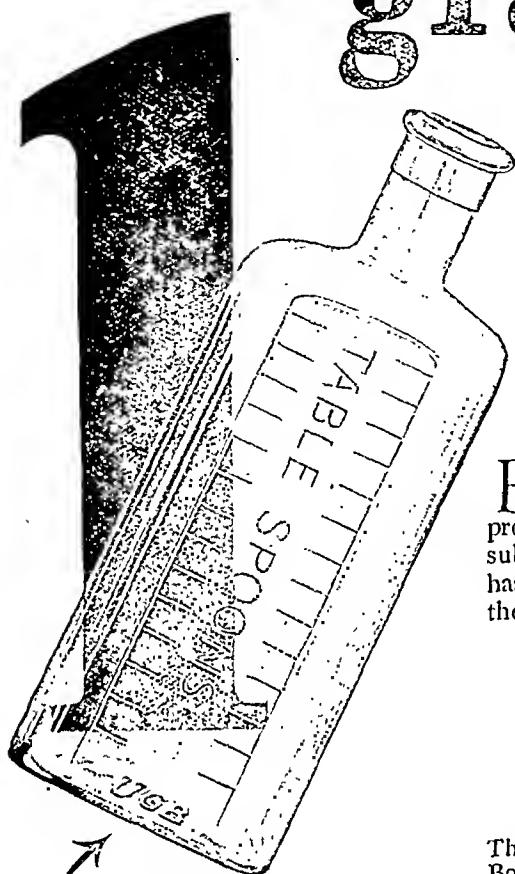
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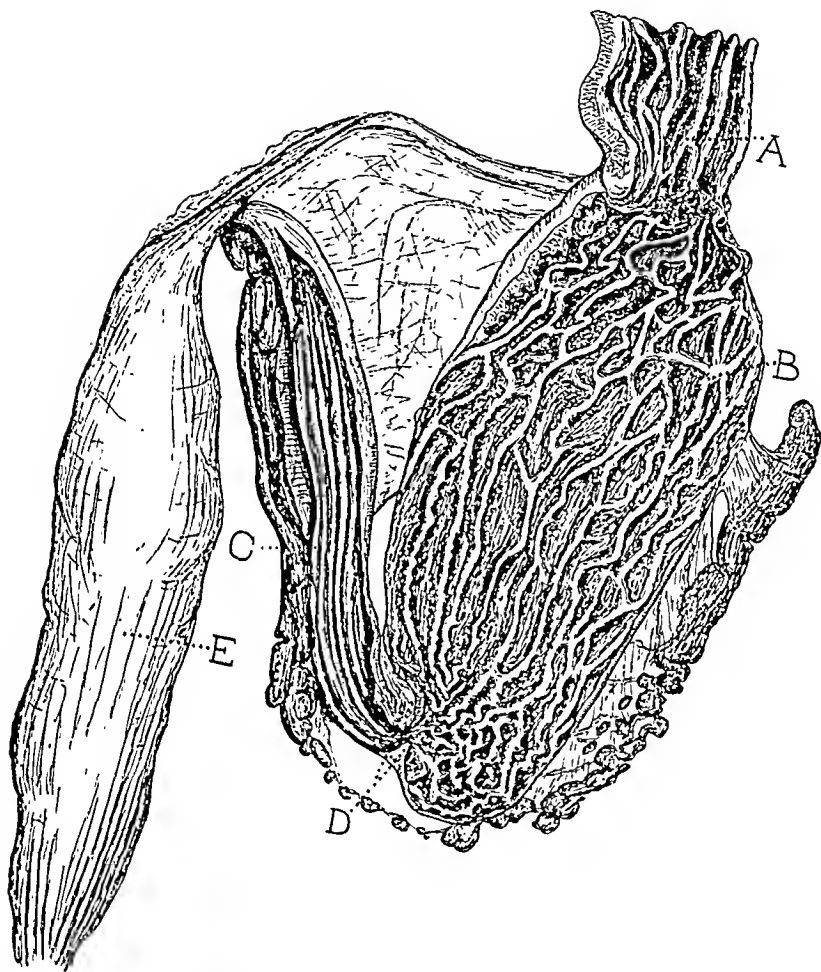


FIG. 8.—Alimentary canal of the shark, the stomach laid open.

A=Lower end of the œsophagus.

B=Cardiac portion of the stomach, separated from the pyloric part (C) by a muscular ring (D).

E=Spiral valve portion of the intestine.

(Below the stomach is the diffuse spleen.)

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with the stomach, forming there a sphincteric ring, which is definitely an œsophageal and not a gastric structure.

Stomach.—The stomach is large and consists of two portions. There is first a wide chamber with prominent folds of mucous membrane, the cardiac portion, which narrows to an outlet in the form of a small opening, surrounded by a ring of muscular tissue, leading into a long narrow tubular chamber,—the pyloric portion of the stomach. The mucous membrane in this part is quite different from that of the cardiac portion, for it is thin and comparatively smooth. There are six slight longitudinal ridges of mucous membrane, running the entire length of this chamber. The pyloric region is of special interest. The stomach wall is continued on as a very narrow tubular channel terminating in a papilla which closely resembles the papilla for the bile duct in the human duodenum, showing the same firm papillary elevation, with a minute orifice on its summit, and with a longitudinal ridge of mucous membrane (frenulum) passing on from it. The wider chamber into which it opens is the representative of the duodenum, a definite segment of the intestine into which open the biliary and pancreatic ducts. Their orifice is on a smaller papilla, similar to the pyloric one, placed slightly lower down on the wall.

The size and form of these portions are shown in Fig. 9.

The duodenal chamber leads on to that extraordinary structure—the spiral valve of the intestine. The region occupied by this extends over a portion of the intestine which was not more than eight inches in length and measured on the average about four inches in diameter. Within it there was an internal spiral ridge forming a left-handed spiral, by which the lumen was altered to form a close spiral in which there are some forty turns. The effective length of the internal surface of the tube is thus extended from 8 inches on the external surface to 13 feet 4 inches of a hollow cavity in the interior, which must be traversed by the food substances contained within it.

The outer muscular coat of fibres is in a very open spiral and within this, the inner muscular coat follows the line of the spiral fold of mucous membrane. This spiral region is followed by a short, straight terminal segment, opening on the surface, whose anatomy need not here be fully described.

Alimentary Canal in the Human Embryo.—In the human

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embryo of the stage at which the heart resembles the shark's heart described above, the alimentary canal shows little resemblances to that of the fish.

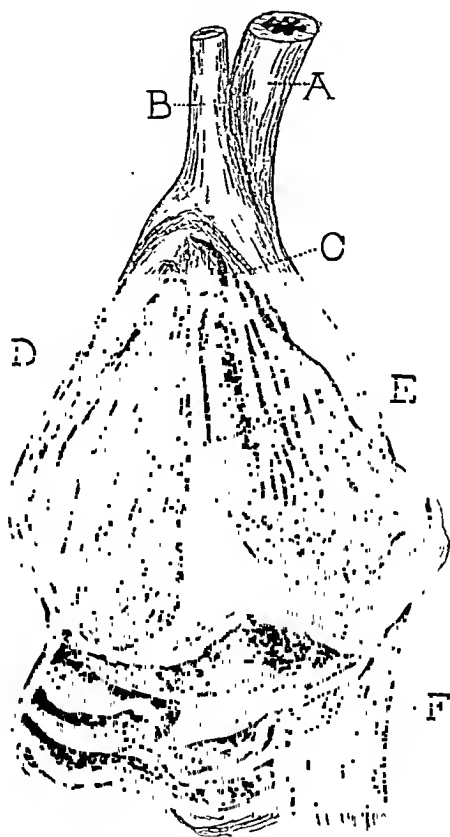


FIG. 9.—Duodenum and the upper part of the spiral valve, laid open to show the pyloric and biliary papillæ, and the commencement of the spiral valve.

- A = Pyloric end of the stomach.
- B = Bile duct.
- C = Pyloric orifice.
- D = Orifice of the bile duct.
- E = Frenulum of the pyloric orifice.
- F = Close-wound left-hand spiral folds of the spiral valve.

The stomach indeed shows two regions, a cardiac and a pyloric, but the duodenum and intestine are differently arranged.

The duodenum forms a loop, and the rest of the intestine

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forms a second large loop, in which the cæcum is appearing as a slight elevation of the wall.

There is no spiral valve region, nor is there any spiral ridge in the interior of the lumen.

It has recently been shown by Carey that the muscular coats of the intestine in several mammals which he examined, and in man, are not "circular" or "longitudinal" in the direction of the muscle fibres which comprise them, but that they are arranged as left-handed spirals, the inner coat closely wound and the outer a very open spiral.

It may be noted, that if this view is confirmed, a new and very important light will be thrown upon the phenomenon of "peristalsis," which will, as Carey points out, be explicable on grounds very much simpler than those at present postulated by the current physiological teaching.

The "*plicæ circulares*" of the small intestine do not lie circularly, but form portions of a close wound spiral, but the turns are not continuous but interrupted.

In these two aspects we may detect in the adult evidence of a spiral formation in the wall of the intestine, but the arrangement is vastly different from that of the "spiral valve" of the shark.

The conclusion is obvious, namely, that the human embryo does not, in its alimentary tract, approximate closely to the condition of the shark.

The condition of the heart was very different, and it may be permissible to suggest an explanation of the difference in the two systems.

In my view, it is to be found in the difference of the functional activity of the two systems. In the embryo, the heart and the circulation are actively at work, while development is going on, and as the nature of the circulation is the same in the embryo and the fish—*i.e.*, it is purely systemic and not "pulmonary"—it is not surprising to find that the structure of the heart is similar.

The alimentary canal, during its development, on the other hand, shows no similar functional activity—it is entirely passive—and passes from a simple loop to the complex adult form by a gradual series of changes which occur independently of any adaptation to temporary functional activity.

The form of the intestine and its arrangement in the shark are such as adapt it to a small abdominal cavity, determined

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by the shape of the trunk of the creature. Hence the concentration of great intestinal length within an area of intestine relatively short, and the spiral valve.

In man, the trunk is different in shape, and so is the abdominal cavity. Room is provided for a long continuous tube, which is a simpler form of tube than in the shark, but one which in some details of the adult form shows the tendency for the formation of a spiral form.

The alimentary tract of the shark is not a simple or "primitive" form, but is modified from that form as an adaptation to the form of the trunk.

CRITICAL REVIEW

SUPRARENALECTOMY FOR TROPHIC DISTURBANCES.

POSSIBLY the most cogent argument for partial unilateral supra-renalectomy for threatened spontaneous gangrene is the hopelessness of obviating amputation by other procedures. M. S  n  que reviews to date the literature of the subject. The statistics are drawn from Herzberg, Oppel and Leriche, giving a total of 112 cases. The operation was founded on the idea that gangrene in individuals between the ages of 30 and 40 years was due to spasm of the peripheral vessels due to hyperadrenalin  mia from excessive activity of the suprarenal glands. Ultimately changes in the vessel walls aggravate the condition and there is an increased tendency to thrombosis. The theory is not incontrovertible, but it is not with that that the paper deals.

Of the 112 cases subjected to supra-renalectomy 33 had been submitted to previous surgical operations, such as peri-arterial sympathectomy, ligation of veins, etc.

The age of the patients was between 30 and 50 years.

Of the 112 cases the disappearance of pain and the cicatrization of ulceration occurred in 14, but sufficient time had not elapsed to justify a permanent improvement being claimed.

In 8 of Herzberg's 106 cases gangrene recurred three months after supra-renalectomy and required amputation within the subsequent two years.

In the 112 cases there were 19 deaths. Of these 4 had nothing to do with the operation; 3 died of post-operative shock; 1 of cardiac failure; 5 of septic infection; 4 of post-operative pneumonia; and 2 died of suprarenal insufficiency. The last item is a serious argument against any previous hyperadrenalin  mia unless there was congenital absence of the opposite gland. With inability to assure the presence of a second suprarenal, the possibility of congenital absence or destruction from disease constitutes a real danger.

In 50 cases in which pain was the serious feature 33 were relieved, ulceration healed in 5 cases and the pulse reappeared in 28 cases. Such relief may be but temporary. It is not surprising that improvement is often transient, for in most cases secondary arterial changes have proceeded too far towards obliteration. It is suggestive that in Russia where Oppel, in 1921, introduced the operation and published 3 cases, in 1922, 37 cases were recorded, in 1923, 44 were reported, in 1924 only 14, and in 1925 and 1926 only 1 case.

S  n  que concludes that supra-renalectomy rests only on a pure hypothesis without either anatomopathological or biochemical support and has not received clinical confirmation. Investigation *de novo et ab*

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initio is required to clear up the pathogenesis of these spontaneous gangrenes.

Oppel affirms that the more he sees of spontaneous gangrene and its treatment the more convinced he is that hyperadrenalinæmia is the cause and that suprarenalectomy is the remedy.

The experiments of Tournade and Chabrol and the observations of Savitch have controverted Gley's statement that no adrenalin was to be found in the peripheral circulation. Those working with Oppel found that injection of the serum of an individual suffering from spontaneous gangrene produced when injected into animals those symptoms which we associate with the presence of adrenalin. The transplantation of ox suprarenals into a rabbit is followed by a malady very similar to spontaneous gangrene. Oppel points out that suprarenal arteritis is much more common in relatively young people, for example, under 40 years of age. It specially occurs in the arteries of the lower extremities, and the absence of pulse in the vessels of the foot is the result of spasm and liable to lead to thrombosis. The reappearance of the pulse after suprarenalectomy he considers proof of spasm and of diminution of the adrenalinæmia. The arterial changes are general, not local, and thrombosis may occur in the opposite limb, in the mesenteric arteries, in the arteries of the upper extremity or in the neck leading to hemiplegia and even in the cardiac vessels. If the patient has been suprarenalectomised before such an occurrence, thrombosis does not take place in the vessel of the limb which has been operated on. Anitchkov showed that, contrary to previously expressed opinions, adrenalin narrowed the coronary arteries. This weakens the heart by myocardial changes, and thrombosis may bring about an attack of true angina pectoris which may readily prove fatal.

Oppel does not lay the same stress on thrombosis of the veins as Buerger has done, and he has recommended and has practised ligature of the veins to increase the blood content of the affected limb. Oppel and his pupils found a marked hyperthrombocytosis in the blood of these patients which Oppel considers is evidence of hyperadrenalinæmia because Stéphan had found that the hormone from the suprarenal cortex paralysed the hæmolytic action of the spleen. Clinically and experimentally Oppel found that adrenalin had the same effect. There is an increased viscosity of the blood and coagulability is hastened. The blood sugar appears to be invariably increased if the disease is progressive. A hypoglycæmia indicates resolution and contra-indicates operation. It has been further observed that the quantity of blood sugar returns to normal after suprarenalectomy in these cases.

Oppel is convinced that suprarenalectomy, of which he and his collaborators have now done 115 cases, is a valuable addition to surgical procedure. Herzberg's statistics give a mortality of 15 per cent., and in Oppel's first 29 cases the mortality reached 17.3 per cent., but

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since then it has diminished, and in the last 50 cases only one case proved fatal.

Spasokukotzky lost a patient after left suprarenalectomy, in whom subsequent examination showed an atrophic right gland. To obviate such a disaster, Oppel recommends that the gland which is not to be operated on should some days before the operation be exposed to irritant doses of X-rays when it will be found that the thrombocytes have been increased in number and the blood sugar and the blood lipase will be increased in quantity. Some operators, to obviate the same danger, leave a third of the gland *in situ*, but Oppel is averse from this, as the other gland is in all probability hyperfunctioning also. In 115 suprarenalectomies there were three cases of post-operative weakness due, Oppel presumes, to hypofunction of the opposite gland. The collapse was temporary and relieved by hypodermic injections of adrenalin.

Suprarenalectomy cannot clear up a thrombosis nor make a blocked vessel permeable, but it relieves spasm in vessels not yet thrombosed, and to that extent improves the distal nutrition. The most painful limbs are cyanosed and oedematous, improvement in the circulation relieves both these conditions and the pain disappears as if by magic. If gangrene has commenced, suprarenalectomy localises it and accentuates the line of demarcation, but the best results follow if suprarenalectomy is carried out before the distal pulse has disappeared and gangrene has set in. Recurrence of gangrene occurs in 20 per cent. of cases.

It is a pity Oppel does not give the statistics of his suprarenalectomies, the paper is concerned rather with supporting the hyperadrenalinaemia theory than with advocating the effectiveness of the operation.

At the February meeting of the Société de Chirurgie de Marseille, M. V. Aubert showed a Spaniard, aged 25 years, who fifteen months previously had the right middle toe, and a month later the right hallux, amputated for gangrene with pain, coldness, and cyanosis. Seven months afterwards the hallux cicatrix ulcerated and refused to heal under various local applications. Two-thirds of the left suprarenal gland were removed. Within twelve days the ulceration had cicatrised with a marked and progressive amelioration of his symptoms. His general health improved and the circulation in the limbs approached the normal. The cyanosis entirely disappeared within the subsequent six months. Though he had returned to work five months before being shown to the Society there was no appearance of recurrence of the ulceration of the foot.

REFERENCES.—J. Sènèque, "Résultats de la surrénalectomie dans les gangrènes spontanées des membres," *La presse méd.*, Paris, 1927, xxxv., 454. W. O. Oppel, "Gangrène spontanée et surrénalectomie," *Lyon Chirurgical*, Paris, 1927, xxiv., 1.

PERISCOPE

JEJUNOSTOMY.

The comparison between the relative merits of jejunostomy and gastrostomy has led to a preference for the former in a constantly increasing number of surgical conditions. Carried out under local anæsthesia, jejunostomy is more easily performed than gastrostomy, and is the simplest way to make an alimentary fistula without reflux, leakage, or excoriation of skin. No secondary operation is required to close the stoma. The indications for the operation are thus summarised:—1. Conditions characterised by obstruction at any point between the mouth and stomach—stenosis of the œsophagus, infiltrating carcinoma, cardiospasm, inoperable carcinoma of the tongue, mouth, and neck. In this group the indication has been the demand for some means of artificially maintaining nutrition. A case of cardiospasm is quoted, in which the jejunostomy tube was used for eight months with a gain of 47 lb. in weight. 2. In accidental and surgical injuries to the stomach, where the attempt to close the defect is not successful. In certain cases a stomach defect has been closed by use of the omentum and parietal peritoneum. A temporary jejunostomy was employed in one such case with post-operative success. 3. In widespread ulceration of the stomach, in which a long period of complete gastric rest is imperative, the jejunostomy being regarded as an adjunct to medical therapy. 4. To safeguard the integrity of the line of suture in gastro-intestinal anastomosis, where, after resection of the stomach, there is an imminent risk of leakage. 5. In post-operative ileus and diffuse spreading peritonitis. 6. In perforating gastro-duodenal ulcer, where doubt is entertained as to the firmness of the closure of the perforation, jejunostomy is a simpler operation than gastro-enterostomy, and much more speedily performed. 7. As a preliminary to resection or excision of the larynx, jejunostomy is indicated, and should be performed at the same time as tracheotomy.

The importance of the use of jejunostomy in cases which come under group 5, is generally recognised, and stress is laid upon the opening in the jejunum being made as high as possible. The operation is carried out through a 3-inch incision splitting the left rectus, midway between the umbilicus and the costal margin. Difficulty in identifying the first portion of the jejunum would only be encountered in cases of diffuse peritonitis, with marked distension of the intestine. By making the jejunum taut, and passing the thumb on one side of the mesentery, and the fingers on the other, the direction of the mesentery can usually be determined. Given thus the direction of the bowel, one can work upward and save the unnecessary dislodgment of coils of ileum.

The technique of inserting the soft rubber catheter (No. 28, French)

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is that which is usually employed, a purse-string suture of catgut being first made between clamped off portions of jejunum. The end of the catheter is cut obliquely, and has two apertures in the distal 2 inches. After tying the purse-string, a portion of the tube is made to lie in a trough in the wall of the jejunum, in the Witzel fashion, and finally, the omentum is wrapped round the suture line.

Elaborate details are given of the diet suitable for various conditions, and it is stated to be ordinarily well digested and assimilated.

CHARLES GORDON HEYD, "Jejunostomy" (*The American Journal of Surgery*, October 1926). J. J. M. S.

DIVERTICULITIS OF THE SIGMOID ASSOCIATED WITH TUBERCULOSIS.

Diverticulitis and hyperplastic tuberculosis of the colon are now well-recognised lesions, but the co-existence of these two conditions is extremely uncommon. The author reports two cases, the only two in a series of over 100 cases of diverticulitis examined.

In the first case the patient was a man aged 48, who developed a vesico-sigmoidal fistula. At operation the mass in the colon was resected and the opening in the bladder closed. He made a good recovery, but two years later he developed swelling of the testicles and a sinus appeared in the scrotum, in the discharge from which tubercle bacilli were found. Examination of the operative specimen showed the macroscopical appearance typical of diverticulitis, while microscopically numerous miliary tubercles and giant cells were seen in the subserous coat of the bowel and there was a marked increase of eosinophilic leucocytes. The second specimen, removed from a man aged 55, resembled a carcinoma while *in situ*, but after resection it was found to be a typical diverticulitis. As in the previous specimen well-marked miliary tubercles and giant cells were seen in the subserous coat.

Both diverticulitis and hyperplastic tuberculosis, especially of the subserous type, are capable of producing almost identical pathological pictures. When they are co-existent there is great difficulty in assessing the part which each plays in the production of the granulomatous tumour. In the two cases reported the pathological findings, with the exception of the miliary tubercles, the giant cells and the increase in the eosinophilic leucocytes, were typical of diverticulitis.

Giant cells may be found in the lesions of diverticulitis, but it is the author's opinion that they are rare, and that if present they are not the centres of the formations that occur in tuberculosis. Tubercle bacilli are usually very scanty in these lesions, and in the cases reported they could not be demonstrated.

ROBERT MAILER (*The American Journal of Surgery*, February 1927).

K. P. B.

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DIVERTICULITIS OF THE COLON.

Diverticula of the colon and sigmoid are almost certainly of frequent occurrence, but they may exist without causing any symptoms. While some observers have found diverticula of the colon in one-third of the cadavers of the aged, the exact incidence of the condition is difficult to determine. Sixty per cent. of cases occur in obese subjects, and males are more frequently affected than females, the commonest site being the lower part of the sigmoid.

The sigmoid diverticulum is a true herniation of mucosa through a weak area in the muscularis. Some observers believe that this protrusion takes place along the line of the epiploic vessels, but the author considers that the replacement of the muscle by fat is the true cause of the condition. The fact that these sacculi become filled with faecal material, and that the drainage from them into the lumen of the bowel is very imperfect, accounts for most of the secondary changes that occur and for the symptoms which are produced.

The complications which may ensue can be shortly stated:—
(1) Inflammation causing obstruction in the sac and resulting in a condition comparable to obstructive appendicitis; (2) a low grade hyperplastic inflammation associated with leakage of toxins through the devitalised wall but without true perforation; (3) annular constriction of the sigmoid simulating scirrhus carcinoma; (4) adhesions between the peridiverticular inflammatory mass and other viscera, chiefly the bladder; (5) formation of abscesses which may burrow in fascial planes, causing fistulae of various types.

From a study of the pathology it is evident that diverticulitis may cause a variety of symptoms, but clinically "left-sided appendicitis" is quite descriptive of the usual attack of diverticulitis. The author has found neither the sigmoidoscope nor X-rays of great value in diagnosis. He points out that when looking for diverticula of the sigmoid it is important to take X-ray plates three or four days after the barium has passed, as the diverticula are much more often seen when the colon is empty.

[Most observers will agree with the author's statement regarding the value of the sigmoidoscope, but X-ray examination is generally considered to be of great value in the differentiation of diverticulitis from carcinoma. Not only are the diverticula shown in the plates, but it is frequently found that, where there is obstruction in the pelvic colon of an inflammatory nature, a bismuth enema passes through the stenosed area to the more proximal colon, whereas a malignant stricture tends to arrest completely the bismuth.]

A study of the 11 cases of diverticulitis described illustrate how this condition may simulate other intra-abdominal lesions. The author considers that the condition described as an "epiploic appendicitis" is

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really due to a primary inflammation of a small diverticulum, with a resulting protective adhesion of the epiploic appendix which becomes secondarily inflamed. The formation of an abscess following acute diverticulitis may result in a large abdominal swelling associated with vesical irritability and tenesmus, which may suggest carcinoma. Similarly the chronic form of peridiverticulitis may simulate cancer, and this "cancer" belongs to the type which, thought to be irremovable, disappears after a colostomy.

Diverticulitis probably has a relationship to cancer of the colon. Of 42 cases of diverticulitis there were 13 in which cancer was present. Cancer starting from a diverticulum has two characteristics: (1) the cancer tends to grow away from rather than towards the lumen of the bowel, which therefore shows no filling defect in the radiogram; (2) the early symptoms will not be those of partial obstruction but rather of slow perforation and abscess formation.

The treatment of the condition must vary greatly according to the type of lesion present, but it may be summarised as follows:—waste-free diet and colonic irrigations in chronic cases; drainage in perforations and abscesses; resections of the intestines or colostomies as may be indicated.

MAX BALLIN (*The American Journal of Surgery*, February 1927).

K. P. B.

A NON-TOXIC TEST FOR LIVER FUNCTION.

In this article the authors strongly advocate the use of the new dye "bromsulphthalein" (Rosenthal and White) instead of the older and more dangerous "Phenoltetrachlorphthalein" in the estimation of liver function. Working with a series of very interesting cases of liver disease they have proved the new dye to be practically non-toxic and in every way quite as reliable as the older and more toxic product. They point out the great value of test in the differential diagnosis of hepatic disease, and that owing to its ease of administration it should be employed whenever necessary for the determination of normal and abnormal liver function.

JULIUS FRIEDENWALD and W. W. ARMSTRONG, "Some Observations on the Bromsulphthalein Test in the Chemical Study of Liver Functions" (*Medical Journal and Record*, New York, 1st December 1926, p. 679).

A. L. W.

FASCIAL SUTURES IN THE TREATMENT OF HERNIA.

In place of catgut or kangaroo tendon, the employment of living sutures cut in strips from the fascia lata, as introduced by Gallie and Le Mesurier, is specially indicated in the operative treatment of

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recurrent inguinal, direct inguinal and large scrotal hernias with poor musculature. It is also a valuable aid in dealing with post-operative ventral hernia the large umbilical type.

With regard to inguinal hernia, if the tissues be lax, the internal-oblique and conjoined tendon should be stitched down to the deep surface of Poupart's ligament by two continuous sutures, one above the other. If, however, this technique would result in undue tension being created, a sock-darning method of repair should be utilised. Where possible, the two layers of external oblique aponeurosis should be overlapped, so that the medial layer is stitched to Poupart, the lateral layer is stitched up to the surface of the medial, and the cord is made to lie subcutaneously, anterior to both.

In a series of 50 cases with 63 hernias of various types, wound infections, ranging in severity from stitch abscesses to extensive infection of the deep layers, occurred in 22 per cent. These results have led to the belief that this method is more apt to be followed by wound infection than the simpler hernioplastics. The average age of the patients in this series was 44.7 years and the mortality was 2 per cent.

Of 34 hernias followed up to a period of three months recurrence took place in 17.9 per cent., while in 24 hernias seen after six months the figure was 25 per cent. Of 24 recurrent hernias operated on, further recurrence manifested itself in 4 cases, representing 16.6 per cent.; of these 15 were followed which gives a recurrence rate of 26.6 per cent. This last figure is probably too high an estimate for all the cases in this class.

Analysis of the six recurrences in this series showed that four were in recurrent hernias and three followed severe post-operative wound infection with sloughing of sutures. Wound infection in 11 cases, however, did not prevent firm repair as an end result.

The relatively high percentage of recurrence should not be construed to mean that this method is not productive of better results than the simpler methods. This series of cases, selected from a group of 400, represents those which were poor risks for cure by any other means.

BRADLEY L. COLEY and EDGAR BURKE, "The Operative Treatment of Hernia by Living Sutures" (*The American Journal of Surgery*, vol. ii., No. 1, January 1927). R. L. S.

THE CREMASTERIC REFLEX.

A lesion of the pyramidal tract in man is known to cause a disturbance of the two skin reflexes;—the abdominal and cremasteric. Of these the abdominal reflex is most liable to be absent or diminished on the affected side, while the cremasteric reflex may be only slightly or not at all affected.

The abdominal reflex is absent in animals, in new-born children

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and only appears in the second half of the first year. It is associated with the acquirement of the vertical posture.

The cremasteric reflex is present in some mammals, and is found in the new-born child. In origin it is thus an earlier and an older reflex than the abdominal one, having a higher phylo- and onto-genetical antiquity.

The reason for the loss of the abdominal reflex in pyramidal lesions without loss of the cremasteric is possibly to be explained by the fact that we lose just in disease those reactions and reflexes we have most recently acquired.

G. ARONOVITCH, "On the Nature of the Cremasteric Reflex"
(*Journ. Nerv. and Ment. Dis.*, 1926, lxiv., 235-240).

N. B.

DIATHERMY IN NÆVUS-CELL CARCINOMA.

Ravant and Ferrand give the results of the treatment of thirty cases of nævus-cell carcinoma by diathermy. There had died after treatment four; there were still under treatment four, and there were twenty-two who were apparently cured. Of those who died one was a woman of 60 years whose melanoma of the nape of the neck associated with glandular enlargements healed after treatment, but death resulted sixteen months later after repeated cerebral hæmorrhage. In this case the cicatrix was soundly healed and showed no sign of local recurrence. A second patient, in whom melanoma of the forehead with enlarged glands had existed for three years, died a month later from generalised affection. In the third patient, death occurred suddenly from intestinal hæmorrhage sixteen days after operation, though her facial tumour appeared a very suitable one for operation and was unaccompanied by enlarged glands. The fourth patient committed suicide by hanging.

The four persons still under treatment were suitable cases and had no glandular involvement. One had been operated on surgically eight months previously for a melanoma of the sole which had recurred. She was well and the ulcer soundly healed thirty-four months after her diathermy.

Of the twenty-two subjects who were apparently cured, five could not be traced though there was reason to believe none had had any recurrence. Of the others—three had survived for less than six months; six had survived between six and twelve months; six had survived between twelve and twenty-four months; one had survived between twenty-four and thirty-six months; one had survived more than thirty-six months.

[*Note*.—Too short a time of observation has elapsed to make this interesting communication of real value. Such success not infrequently

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attends ordinary surgical intervention, and it must not be forgotten that recurrences, metastases or generalisation, may be delayed in nævus-cell carcinomata for many months and often for several years.]

P. RAVANT et M. FERRAND, "Le traitement des nævo-carcinomes par la diathermo-coagulation" (*Bull. et mém. de la soc. nat. de chirurg.*, Paris, 1927, liii., 150).

DISSOCIATION OF TESTIS AND EPIDIDYMISS.

A man, aged 29, was admitted to hospital with the diagnosis of a left oblique inguinal hernia. At the inguinal ring there was an easily noticeable tumour with an impulse on coughing. The finger entered the inguinal canal easily and the pulsations of the hypogastric artery were felt. In the right scrotum there was a normal testis. The left scrotum was smaller than usual and contained a very small organ, pressure on which caused pain in the inguinal swelling. On operation under local anæsthesia the sac contained a structure attached to the cord which was taken for the testis itself, but on traction on the sac the testis appeared from the canal and showed the scrotal structure to be the epididymis. The testis appeared quite separated from the epididymis except for a membranous connection 40 mm. in length. The cord was with some difficulty freed from the sac, which was then isolated and stitched. The testis and epididymis were then brought together by stitches and replaced in the scrotum. A month later the position of the testis was quite satisfactory.

The separation of the two constituents of the testis was such in this case that it was difficult to see how the testicular secretion could pass to the epididymis but the efferent ducts may have passed from the superior pole of the testis across the mesorchium towards the epididymis.

Embryologically the anomaly is not difficult of explanation, as union between the testis and the epididymis is late in completion. Such anomalies are not accompanied by atrophy of the testis, spermatogenesis persisting; both congenitally and experimentally suppression of part of the duct is known not to interfere with this function.

Note.—This is an interesting exaggeration of a dissociation between the testis and epididymis familiar to those who have experience in the radical cure of hernia in infants.

J. ZIPPER, "Eine seltene Anomalie des Hodens bzw des Nebenhodens" (*Zentr. f. Chirurg.*, Leipzig, 1926, liii., 1182).

D. M. G.

NEW BOOKS

An Introduction to Clinical Perimetry. By H. M. TRAQUAIR, M.D., F.R.C.S. (Edin.). Pp. viii+264 with 164 illustrations and a coloured plate. London: Henry Kimpton. 1927. Price 30s.

Every ophthalmologist and many physicians and surgeons will wish to possess this book, in which Dr Traquair gives not only the results of his own original investigations, but also a comprehensive summary of present day knowledge of perimetry in its clinical aspects. The Edinburgh School of Ophthalmology has done much to make the quantitative method of perimetry which is essentially the method of Bjerrum, known to English-speaking ophthalmologists. Berry's communication in 1890 was followed by two important papers by Arthur Sinclair, and since then the painstaking work of Traquair has given him an established reputation as one of the foremost and most authoritative exponents of this form of visual field testing. This book is an amplification of the author's Middlemore Essay for 1920, on "Perimetry (inclusive of Scotometry): Its Methods and its Value to the Ophthalmic Surgeon." It does not attempt to deal exhaustively with perimetry, but aims at introducing the reader to its essential principles considered in their clinical aspect. The first part deals with the normal field of vision and the various instruments and methods employed in perimetry. The difficulties are not physical but subjective, and Traquair wisely insists that the perimetrist must never allow the excellence of his apparatus to govern his interpretation of the results obtained. "Simple tools properly used are much less productive of wrong conclusions than undue reliance on the dicta of an elaborate instrument." The second part of the book is devoted to the interpretation of the various pathological changes that may occur in the field of vision. It consists of chapters dealing with the choroid and retina, glaucoma, the optic nerve, the chiasma, the suprachiasmal pathway, and functional changes. The author quotes with approval the saying of Roenne, the disciple and follower of Bjerrum—"It is a peculiarity of perimetry that its outward technique is so simple as apparently to make no demand but to be feasible to the least experienced assistant of a clinic, and yet of all ophthalmic examinations it is perhaps the one which in reality requires the most experience and detachment." Traquair himself while insisting upon accurate observation and careful charting of the defects in the field occurring in different diseases, constantly warns his readers that these changes must always be considered in their relation to the clinical picture as a whole, because no

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single sign or symptom, no matter how important it may be, if considered by itself affords conclusive evidence in diagnosis or prognosis.

We can heartily recommend this book and wish it the success it deserves. The publishers have done their part well—the printing and the illustrations are excellent.

Practical Methods in the Diagnosis and Treatment of Venereal Diseases.

By DAVID LEES, D.S.O., M.A., M.B., F.R.C.S.E. Pp. xvi + 605, with 87 illustrations. Edinburgh: E. & S. Livingstone. 1927. Price 15s.

As a handy little volume to give the student an introduction to the study and treatment of venereal diseases Dr Lees' publication will doubtless fulfil its function. There are assigned to syphilis 289 pages, to soft sore 6 pages, to gonorrhœa and its complications 245 pages, and a short pharmacopeia in conclusion occupies 26 pages. It is supererogatory to preface that this manual is not a book of reference.

The volume is modelled on the well-known Thomson and Miles' *Manual of Surgery* and with such restriction in size it is necessary that every word be selected with care, that every phrase be attuned, and that every sentence be turned to the best advantage for the instruction of the reader and that no space be wasted that might be utilised. These provisos are not altogether fulfilled in this edition. Take, for instance, the first sentence in chapter II. "Syphilis is an infectious disease" (would "contagious" not better describe this attribute?) "of which there are two main types" (why "main"? Are there subordinate types?): — "(1) Acquired syphilis . . . (2) Inherited syphilis . . ." On the next opportunity, only eleven lines further on, and elsewhere almost throughout the book the second type is "congenital syphilis." Is not "inherited" the more accurate? This may seem meticulous criticism, but Dr Lees' book is so sure of an extensive vogue that no effort should be spared to enhance its instructional value.

No fewer than six chapters are devoted to the treatment of syphilis. They fairly represent the antisymphilitic regimen of to-day. The principles enunciated seem sound, the tone is optimistic, but perhaps the prescription of "courses," the indications for dosage and the specification of drugs suitable to certain conditions are a little too hard and fast to give the future practitioner scope for initiative.

Some of the illustrations are quite good but a good deal of valuable space might be gained for additional text by docking many of them of unessential parts. In a few the blurred railings and paraphernalia of an operation theatre are too much in evidence, and in some a panchromatic plate with suitable filters would have given

New Books

less blackness to red surfaces. To photograph penile manifestations of syphilis or other venereal disease is extremely difficult and the author has not overcome these difficulties. Little can be learned in a 73×58 mm. picture (Fig. 1) of the characteristic appearances of a sore where the essential organ measures only 14×5 mm., and it does not take half a woman and her hat to illustrate a chancre of the lip (Fig. 3) in which moreover the important enlargement of adjacent lymph glands is not demonstrated. To one who has seen the condition Fig. 6 will recall the appearances, but it is scarcely a picture to instruct a novice. Original photographs are evidence of experience which the author can dispense with and in his next edition might see his way to substitute drawings for such photographs—they would be infinitely more instructive.

The chapters on gonorrhœa and gonorrhœal complications are redolent of practical knowledge, and the chapters on the anatomy of the male and female genito-urinary organs might be replaced by more of it, but should they be retained should have their terms brought into accord with modern nomenclature.

In many cases Dr Lees' ideals for the treatment of gonorrhœa will be unattainable, but that is no reason why ideals should be burked. It is doubtful if from chapter IX the student will appreciate the importance of non-gonorrhœal valvo-vaginitis in children. One need not go back to Sir Astley Cooper's lectures and pre-organismal days to realise the necessity. Few indeed are medico-legal cases and it seems curious that the first question put to the little patient by the experienced general practitioner (or police surgeon): "How old is the sister who sleeps with you?" has escaped the author's practical acumen. Surely the accidental manual transference of her pudendal pus to the child she innocently cuddles in bed is a more common mode of contagion than "napkins, sponges, thermometers and towels."

To call venereal papillomata "condylomata" (page 498) is to confuse the student to whom the condyloma lata is *the* condyloma. And it would be all to the good to give the venereal papilloma a short chapter to itself, to dissociate it from "Conditions met with in association with or simulating gonococcal infection" (chapter XIII) and continue an Edinburgh tradition (cf. *Journ. Pathol. and Bacteriol.*, Edinburgh, 1897, iv. 160) which hide-bound specialists have little appreciated.

The treatment of gonorrhœa by vaccines Dr Lees has made his own, and the manner of his dealing with it in this volume is comprehensive, clear and commendably brief.

This volume is a welcome addition to the text-books of the Edinburgh School, its success is assured, and doubtless future editions will pass from better to best.

New Books

Pyelography. By ALEX. E. ROCHE. Pp. xiii + 118, with 16 illustrations.
London: H. K. Lewis & Co. 1927. Price 9s.

Pyelography has now come to be recognised as a necessary step in the accurate diagnosis of many urinary lesions. Its satisfactory practice, however, requires efficiency in a somewhat delicate technique and an ability to interpret in the resulting radiograms not only gross pathological changes, but also the many slight differences which may or may not indicate a departure from the normal.

In this monograph the author describes a straightforward and practical technique and emphasises the several essentials which go to make or mar the results. The indications and contraindications for pyelography together with the possible complications following upon its employment are dealt with in a commendably lucid manner. The illustrative radiograms are good, but certain of them might, with advantage from the teaching standpoint, have shown more definite changes; especially is this the case in regard to renal tumours and polycystic disease. Though based on a relatively small number of clinical case records, this short volume can be confidently recommended as an up-to-date and reliable guide to anyone desirous of taking up this line of work.

The Nature of Disease. By J. E. R. M'DONAGH, F.R.C.S. Part 2.
Pp. 434. London: William Heinemann, Ltd. 1927. Price 21s.

It is difficult to know whether to take Dr M'Donagh seriously. It is still more difficult to review his book with becoming restraint. The author takes as his starting-point certain elementary facts about colloids and these he proceeds to make as unintelligible as possible. He then discusses the "nature" of disease in terms of hydration, dehydration, gelation, etc., of protein particles, the methods employed in the investigation of such processes being the suspension stability of the red blood corpuscles, the refractive index and viscosity of the serum, and the ultra-microscopic examination of the serum and plasma together with estimations of blood sugar, urea, etc.

This forms the scientific basis, such as it is, of his thesis. The rest is supplied by the author's own perfervid imagination. Throughout the work, no attempt whatever is made to distinguish between what may be matters of observation and that which is purely speculative. Both are set forth with equal confidence and dogmatism. This is not science; it is monomania.

Cystoscopy. By JAS. B. MACALPINE, F.R.C.S. Pp. xvi + 284, with 193 illustrations. Bristol: John Wright & Sons, Ltd. 1927. Price 25s.

To those interested in cystoscopic methods and urological diagnosis this book can be thoroughly recommended, for it provides a really

New Editions

comprehensive and reliable guide not only to the cystoscopic examination proper, but also to the essentials of operative cystoscopy and to the most up-to-date methods of renal investigation, both functional and pyelographic.

Commencing with a sketch of the history of the cystoscope, the construction, applied optics and clinical management of the modern type of instrument are next detailed and illustrated. Following this the technique for the whole process of cystoscopy and the appearances of the normal bladder are described. The numerous difficulties that are apt to beset the beginner in regard to the manipulation of the instrument, the preparation of the bladder, and later the orientation of the viscus are drawn attention to and the means of circumventing them explained. Succeeding chapters deal with the various primary and secondary vesical lesions both theoretically and practically; the differential diagnosis being discussed in each case. A very useful section is that which describes the treatment of papillomata by diathermy. In this connection we would fully endorse the author's "follow-up" methods by which patients thus treated report at intervals for a period of two years after the cessation of active treatment. Only by this routine can dangerous recurrences be avoided.

The book is well written with the practical aspect kept to the fore throughout. An outstanding feature is the large number of coloured cystoscopic views of all the more important vesical changes, these being obtained from actual cases under the author's care.

NEW EDITIONS

Piersol's Normal Histology. Thirteenth Edition, edited and in part rewritten by WILLIAM H. F. ADDISON, B.A., M.D. Pp. vfii + 477, with 432 illustrations. London: J. B. Lippincott Company. 1927. Price 25s.

A book on normal histology intended for use by medical students should present the subject as a preparation for subsequent study of morbid histology. It is essential that the student should acquire a thorough knowledge of the structure of normal human tissues; the study of animal tissues is not equivalent. *Piersol's Normal Histology* has the merit of being truly a text-book of normal human histology; only occasional use is made of tissues of lower animals.

The text is copiously illustrated with microscopic drawings and colour-plates of good quality. Descriptions are clear and sufficiently detailed for ordinary purposes. Reference is made to results of recent

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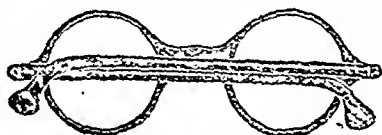
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research, including tissue culture. It is satisfactory to note that an ancient error in the description of the blood-vessels of the kidney, perpetuated by repetition from edition to edition of many books, is not perpetrated here; the arteriæ rectæ are described as arising, not direct from the arcuate arteries, but chiefly from the efferent vessels of deeply placed glomeruli.

Fuller description of the distribution of lymphatic vessels and microscopic lymph-nodes within the organs is called for. These structures, immensely important in pathology, deserve more attention than they receive in most histology books. The author seems uncertain of his ground in describing lymphatics. It is difficult to reconcile two statements made in different parts of the book, viz.: "They (the tissue spaces) come into intimate relation with the lymphatic capillaries, but do not actually open into the latter"; and "The deep lymphatics (of the lung) probably begin as tissue spaces distal to the terminal bronchioles."

At the end is an appendix describing methods of histological investigation. It is obviously incomplete, but may be useful for class-work. There is a list of selected references, mostly to British and American literature, intended for the use of students.

Venereal Disease: its Prevention, Symptoms and Treatment. By H. WANSEY BAYLY. Third Edition. Pp. xv+242, with 77 illustrations. London: Faber & Gwyer. 1927. Price 10s. 6d.

In this new edition, the author has brought his review of the subject up to date by including an account of recent administrative measures for the prevention of venereal disease, and by adding to the sections devoted to treatment descriptions of such recent methods as malarial inoculation in neuro-syphilis and diathermy treatment in gonorrhœa.

The book aims at supplying the student and practitioner with a concise account of the essential facts, and accordingly the author's presentation of his subject is not over-burdened with detail or controversial matter, and, while being remarkably comprehensive, is yet so condensed as to make possible the production of the volume at a reasonable price.

A Manual of Pharmacology and its Applications to Therapeutics and Toxicology. By TORWALD SOLLMANN. Third Edition, 1927. London: W. B. Saunders Co. Price 35s.

The merits of Sollmann's Text-book of Pharmacology will be known to many of our readers, for this book has established, since its first appearance in 1917, a high reputation as the most comprehensive work of reference in pharmacology in the English language. The

New Editions

appearance of the third edition which is under review will therefore be welcomed by all who are interested in this subject, for this book makes it possible to find out quickly the outstanding work that has been done in regard to any particular drug. Not the least valuable portion of the book is the selected bibliography that occupies about 100 pages.

The third edition has been carefully revised and has been brought well up to date, and it will fully maintain the high reputation the book already has established. For example, adequate discussion is given of such recent problems as protein therapy, the antirachitic action of ultra-violet light, the parathyroid hormone and the action of bismuth as an anti-syphilitic.

As we have said, we consider this volume an excellent reference book, but the author states in the preface that it was designed primarily as a manual for medical students, although it was intended to serve as a reference work as well.

Regarded as a manual for medical students the book is not altogether satisfactory, for the main principles are obscured by masses of detail, and the evidence presented often is contradictory. Moreover the general arrangement is somewhat confusing and the size of the volume (1200 pages) alone is enough to frighten the ordinary student. The truth is that the author has tried to combine two incompatibles, for it is impossible to write a book which will be sufficiently clear and simple to serve as a satisfactory text-book for the average student, and at the same time will give sufficient detail and sufficiently full presentation of conflicting opinions to serve as a general work of reference.

The result in this case has been to produce an excellent work of reference, and a text-book that is of great value to advanced students, but the volume cannot be said to provide a good introduction to pharmacology for the average student.

Diseases of the Skin. By R. W. MACKENNA. Second edition. Pp. xii + 450, with 182 illustrations. London: Baillière, Tindall & Cox. 1927. Price 25s.

This work was well worthy of a second edition and it has advanced on its previous standard. It is thoroughly up to date and the coloured plates added are a great advantage. Replete with sound teaching and the outcome of a wealth of experience, for the general practitioner it should be valuable as it deals fully with the common skin diseases. The chapters on psoriasis, lichen and dermatitis artefacta may be mentioned as indicative of the well reasoned views of the author. His literary bent is evident in the interesting style of the composition. The clear printing both of the letterpress and the illustrations are a great asset. In every way this book can be recommended.

New Editions

Manual of Surgical Anatomy. By LEWIS BEESLY and T. B. JOHNSTON.
Third edition. Pp. 563, with 166 illustrations. London:
Humphrey Milford. 1927. Price 18s.

The present edition of this popular text-book shows few changes from its predecessors. A more drastic revision might have been carried out with advantage. We would point out that the operation described for excision of the Gasserian ganglion is no longer performed; the anatomy of the circulation of the cerebro-spinal fluid is not described so that the account of hydrocephalus loses much of its value; the description of the pituitary and of the local effects of pituitary enlargements is very incomplete. The suggestion on p. 387 that, after abdomino-perineal excision of the rectum, the pelvic colon is brought down to the anus and the external sphincter preserved will not meet with general acceptance. The material for this book was selected originally with sound judgment and it is regrettable that these and other blemishes should be carried into a new edition.

An X-Ray Atlas of the Normal and Abnormal Structures of the Body.
By M'KENDRICK and WHITTAKER. Second edition. Pp. 256,
with 448 figs. Edinburgh: E. & S. Livingstone. 1927. Price 30s.

The second edition of this Atlas, of which the first appeared two and a half years ago, has been revised and enlarged. It is evident that this type of atlas is popular and it should be of use to the student anxious to revise rapidly a large collection of radiographs of the normal and abnormal. The book is well printed and the radiographs beautifully reproduced.

The best section is that dealing with bones and joints. The sections on the skull and chest are decidedly weak, the radiographs not being of good quality. In further editions it would be an advantage to improve these sections, and if the various standard positions for radiography of the skull were given it would add to the value of the book. In an atlas of this kind what the student really misses in studying the radiographs is the evidence on which the X-Ray findings have been based. Merely to label a radiograph is not sufficient. If, in a future edition, the authors could attach to each radiograph a short description, from the radiological view point, the book would have a greatly enhanced value.

NOTES ON BOOKS

Messrs Lea & Febiger, Philadelphia and New York, have sent us:—

A Manual of Proctology, by T. Chittenden Hill, Ph.B., M.D., F.A.C.S. (\$3.50). Proctology is a subject which, while forming a large portion of the general surgeon's work, is, as a rule, inadequately taught in text-books. The second edition, therefore, of this very readable manual on this subject written by a specialist is assured of a warm welcome. Dr Coffey contributes the chapter on radical operations for carcinoma of the rectum, and describes the principles of "devascularisation" and "quarantine drainage" as applied to the abdomino-perineal operation. The chapters on hæmorrhoids, rectal abscess and fistula are full of sound advice evidently founded on a wide experience of these sometimes difficult maladies.

Fundamentals of Dermatology by Alfred Schalek, M.D. (\$3.00), is intended for students and practitioners. The diseases are described in alphabetical order, a convenient method. It might have been better in such a book to omit the rare diseases, and give rather more detailed treatment. Some of the photographs are unsatisfactory, but these minor criticisms will not detract from the usefulness of the book.

Emergency Surgery, by George de Tarnowsky, M.D., F.A.C.S., D.S.M. (\$7.50). Professor de Tarnowsky has been unfortunate in his choice of a title, as this extremely interesting book deals purely with the surgery of injuries received during industrial employment, and not with emergency surgery as the term is generally understood in this country. He has, however, succeeded admirably in his object of applying the knowledge derived from military surgery to industrial work. On page 425 an X-ray of a dorsal dislocation of the terminal phalanx of a finger is described as an epiphyseal separation of the middle phalanx. This book will well repay close study by all hospital surgeons.

We have received from Messrs Saunders & Co., Philadelphia and London:—

Obstetrics for Nurses, by J. B. De Lee (15s.), which has now reached its eighth edition, shows very clearly the difference in the amount and quality of the knowledge required by the nurse sitting her C.M.B. examination in this country, and the obstetric nurse in America. The book is essentially practical and would be of use to the labour ward sister in preparing for obstetric operations, etc. For the average nurse in this country, however, it would be by itself of little value, as much of the essential theory of obstetrics is not

Notes on Books

included. It would also appear that much has been included which is beyond the average nurse's requirements, viz.: Gwathmey's Synergistic Analgesia, anæsthesia in labour, etc.

Hygiene and Sanitation (10s.) is by the Professor of Physical Education, Teachers' College, Columbia University, and aims at giving "The essentials of modern health care." Dr Williams has succeeded in compressing an enormous amount of information into small compass, and—what is far more difficult—without sacrificing his selective judgment of the relative value of facts from the medical aspect. While, however, hardly more than elementary for medical men, some of the information given seems extremely technical for the average non-medical teachers for whom presumably the book was produced. It is admirably arranged, the synopsis heading each chapter being especially helpful.

The second edition of *The Diseases of Infants and Children*, by Professor Griffith and Dr A. Graeme Mitchell (9os.), is a complete review of our knowledge of pediatrics. Some new illustrations and tables have been added and some of the articles have been revised, while others have been completely rewritten.

Much of the work is the embodiment of the authors' wide experience in the study of diseases in children. The authors have not hesitated, however, freely to incorporate valuable contributions of other workers and in each case they have given footnote references, where quotations have been used. To those specially interested in research in this subject, these notes will be of value. The book should be a valuable addition to the library of those interested in medical pediatrics.

The fourth edition of *An Introduction to Neurology*, by C. Judson Herrick (12s. 6d.), like the earlier ones, is intended to serve as an introduction to the principles of the anatomy and physiology of the nervous system without preventing any detailed application of them. The author considers that an attempt to organise our knowledge in definite functional patterns allows a better appreciation of the significance of the nervous system as a working mechanism. The text has been carefully revised and brought up to date with recent research, the chapters on the cerebellum and the sympathetic nervous system being entirely rewritten. Numerous references to literature are given, and there is a good index and glossary.

Mr Humphrey Milford, Oxford University Press, has published:—

Normal Midwifery for Midwives and Nurses, by G. W. Theobald (10s. 6d.), embodies a course of lectures given to nurses when the author was assistant master at the Rotunda Hospital. More than in

Notes on Books

most books of its size a sense of proportion has been carefully preserved, so that, while the conduct of normal pregnancy and labour is adequately described no more theory is offered beyond what a nurse may reasonably be expected to know in order to practise. The book gains in attractiveness by the original manner in which much of its matter is presented. It is simply and clearly written and adequately illustrated.

Therapeutic Malaria, by G. de M. Rudolf. (12s. 6d.) The volume contains the author's experiences of treatment of cases of general paralysis, etc., with benign tertian malaria at Claybury Mental Hospital. In addition to general paralysis good results have been obtained in tabes and neuro-syphilis, syphilis, and dementia præcox. The author rightly emphasises the importance of commencing the treatment at an early stage of the diseases, and also that, in some cases, improvement may not be apparent for some time after the cessation of the malarial infection. This line of treatment should be taken full advantage of in suitable cases and this book will be of great help in those carrying out the treatment.

Messrs Baillière, Tindall & Cox have recently published:—

The Flushings of the Menopause, by John H. Hannan (3s. 6d.), emphasises a number of interesting facts regarding the common complaint of the menopause which is often little stressed in various medical and obstetrical works. It is a pity that the monograph had not appeared rather in one of the medical journals, as then it would have been more generally read by the practitioner to whom the work, especially with regard to treatment, would be of great help.

Practical Tropical Sanitation, by E. P. Minett and A. G. M. Severn (5s.), is intended as a pocketbook for Sanitary Inspectors and others in tropical countries and should prove helpful. The difficulties associated with extreme condensation lead to certain amount of obscurity, as, for example in the prevention of malaria, which is summed up in the formula "kill all mosquitoes," a somewhat costly undertaking.

NOTES

THE increasing number of inquiries now being made at the War Office

Royal Army regarding service in the Royal Army Medical
Medical Corps. Corps appear to justify the belief that young qualified medical practitioners are beginning to think more than they have done for several years of service in the Corps as a career which offers many opportunities of advancement not to be found in general practice.

Notes

This change of attitude is no doubt due, in part at least, to the improvements which have been made during the past twelve months in pay and general conditions of service, and to the prospect of more rapid promotion incidental to these changes. The pay and allowances of an unmarried Lieutenant now amount to approximately £511 a year, while a Captain, if unmarried, gets at present rates £617, and if married, £709. These rates, of course, increase with promotion in rank and years of service till they reach the maximum of over £2000 a year, and in addition each year of service carries its element of gratuity or pension.

An officer is eligible for promotion to the rank of Captain on the completion of 3½ years' commissioned service and to the rank of Major on the completion of 12 years' commissioned service, provided that in each case he has passed the necessary examination and is recommended for such promotion. Promotion to higher ranks is by selection and is naturally dependent on the occurrence of vacancies. But last year twenty-three Majors were promoted to the rank of Lieutenant-Colonel, and for new entrants to the service the prospect of advancement to all the higher ranks is now phenomenally favourable.

Two other features of the present conditions of service should be specially attractive to newly-qualified practitioners. Those who take up a hospital appointment can, under certain conditions, get antedates to their commissions—*i.e.*, service in a hospital appointment will count as service in the army—and if for any reason an officer wishes to retire after seven years' service he may do so with a gratuity of £1000, a sum which should go a substantial way towards opening the door to a civil practice.

The next examination of candidates for commissions will be held in January 1928, and meantime full information regarding the service and mode of entry may be obtained on application to the Under-Secretary of State (A.M.D.I.), The War Office, Whitehall, London, S.W. 1, either personally or by letter.

An interesting syllabus for the Winter Session 1927 has been prepared.

James Mackenzie Weekly lectures are to be delivered from 4th
Institute, October till 20th December by representatives of
St Andrews. the various Scottish Schools and others on matters of scientific and clinical interest, and on Fridays at 4 P.M. meetings are to be held for case-reading followed by discussion, to which all medical men are invited.

BOOKS RECEIVED

- BROWN, W. LANGDON. The Endocrines in General Medicine.
(*Constable & Co., Ltd., London*) 7s. 6d. net.
- Calendar of the School of Medicine of the Royal Colleges, Edinburgh.
Session 1927-28 6d. net.
- CARLESS, ALBERT, and CECIL P. G. WAKELEY. Manual of Surgery.
Twelfth Edition (*Baillière, Tindall & Cox, London*) 30s. net.
- COPE, ZACHARY. Clinical Researches in Acute Abdominal Disease.
Second Edition . . (*Humphrey Milford, Oxford University Press*) 10s. 6d. net.
- CRAWFORD, A. MUIR. Materia Medica for Nurses.
(*H. K. Lewis & Co., Ltd., London*) 3s. 6d. net.
- CROOKSHANK, F. G. Diagnosis and Spiritual Healing.
(*Kegan Paul, Trench, Trubner & Co., Ltd., London*) 2s. 6d. net.
- GUY'S HOSPITAL REPORTS. Bright Centenary Number. Edited by
Arthur F. Hurst (*The Lancet, London*) 25s. net.
- HERRICK C. JUDSON. Fatalism or Freedom?
(*Kegan Paul, Trench, Trubner & Co., Ltd.*) 2s. 6d. net.
- JAMIESON, J. D. HAMILTON. Operative Dentistry.
(*E. & S. Livingstone, Edinburgh*) 7s. 6d. net.
- LAKE, RICHARD, and E. A. PETERS. Handbook of Diseases of the
Ear. Fifth Edition. (*Baillière, Tindall & Cox, London*) 12s. 6d. net.
- LLEWELLYN, LLEWELLYN JONES. Aspects of Rheumatism and Gout.
(*William Heinemann (Medical Books) Ltd., London*) 10s. net.
- MCKENDRICK, ARCHIBALD. Medico-Legal Injuries.
(*Edward Arnold & Co., London*) 18s. net.
- MINCHIN, WILLIAM C. A Study in Tubercle Virus, Polymorphism,
and the Treatment of Tuberculosis and Lupus with Oleum Allii.
Third Edition (*Baillière, Tindall & Cox, London*) 25s. net.
- O'DONOVAN, W. J. Dermatological Neuroses.
(*Kegan Paul, Trench, Trubner & Co., Ltd., London*) 2s. 6d. net.
- RAY, MATTHEW BURROW. Rheumatic Diseases.
(*Kegan Paul, Trench, Trubner & Co., Ltd., London*) 2s. 6d. net.
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THERAPEUTIC ABORTION WITH SPECIAL REFERENCE TO METHODS OF INDUCTION.*

By H. S. DAVIDSON, O.B.E., M.B., F.R.C.S.E.

I MAKE no apology for introducing this rather hackneyed

The Transactions of the Edinburgh Obstetrical Society SESSION LXXXVI.—1926-1927

limit the scope of this paper to what I consider sufficient indications for inducing abortion before roughly the fourth month, and to give you the results, so far as they can be correctly ascertained in the Maternity Hospital, and in cases within my own personal knowledge and supervision during the last three years.

The hospital cases differ to a certain extent from the cases one sees in private, because in private frequently a patient is sent for an opinion, not as to whether abortion should be induced, but as to which method should be used. These cases in the light of the papers I have mentioned, make the giving of an opinion the more difficult.

Among the discussable indications for the induction of abortion, I would take hyperemesis first, as it has been the

* Read 8th June 1927.

indication in the greatest number of cases both in hospital and in private. In the Maternity Hospital since 1923 there have been 18 cases of hyperemesis gravidarum which have required interference owing to the severity of the condition. The result has been a mortality of 8 which makes a percentage of 44. In private in my own experience there have been in the same time 15 with a mortality of nil. It is difficult at first to reconcile the difference between these two sets of statistics, but when one enquires more closely into the preceding history the explanation is not quite so difficult. In the hospital cases which died, the duration in hospital before interference was undertaken was on an average 15 days; in private the average number of days was 3. The rule by which I have been guided personally in connection with this condition has been that if the temperature or the pulse is 100 or over for forty-eight hours, the woman is in such a condition that nothing but the termination of the pregnancy is likely to save her life. Among the fatal cases in hospital one finds that in all of the 8 cases the pulse was 100 or over consistently, and to impress this point I would like to read the pulse rate in those cases.

In practically none of those cases was the temperature raised even a degree. In 6 jaundice was present and in 12 not. That I think is the other clinical sign which is of the utmost importance in judging the severity of the condition; but not so important as the pulse rate as, although the jaundice may be a sign of the liver degeneration which is present, it is no guide to the state of the myocardium, which I think is the important point in prognosis and treatment.

Both Professor Oldfield and Professor Lyle state categorically that in this condition a cure can be arrived at by medical and psychological means. I do not know whether our hospital differs in its atmosphere or our obstetricians are deficient in impressiveness, but our results are in direct contradiction to theirs.

As regards heart disease as an indication for abortion I think it is an extremely difficult point for an obstetrician to decide upon; but my own experience has been that mitral stenosis is the most dangerous, and perhaps in that connection I may be pardoned a personal reminiscence—a case where the woman had both mitral stenosis and regurgitation where I induced abortion owing to my previous experience of three deaths within forty-eight hours following delivery in similar

Therapeutic Abortion

cases. The woman became pregnant again and had a living child, but at the time I saw her there were definite signs of heart failure. If one can tide the patient over without signs of heart failure such as œdema, breathlessness on exertion or without much albuminuria, then of course it is a question of method of delivery which is outside this paper, but I mention this type of case because it is of importance that if abortion is to be induced what is the best method. At term Cæsarean section with sterilisation of the patient has been the method of delivery I have adopted.

Phthisis as an indication has been debated for quite a long time, the general opinion I think amongst physicians being that if there is any sign of activity in the lungs the woman is unlikely to survive a full time labour for any length of time. In this connection I would recall a case being quoted in this Society during a discussion where a colleague described a case of phthisis where abortion was induced and the patient was dead two months later. I shrewdly suspect that that was a case in which I operated, but it was not put forward to the Society in its entirety. It was one of those difficult cases where a young woman recently married became pregnant and developed first of all severe vomiting. The consultant was a supporter of the intrauterine life at any price theory, and adduced to her husband that he dare not interfere because of the acidosis present and that an anæsthetic was likely to prove fatal. I do not know whether he realised that there was active phthisis present in addition. I saw her when the vomiting had become very moderate in amount, but the phthisis distinctly active, and the superintendent of the sanatorium in which she was, assured me that there was no chance of her life except by terminating the pregnancy. Her blood count showed R.B.C. of $1\frac{1}{4}$ million with a proportionate diminution in the hæmoglobin. I felt I had no option but to terminate the pregnancy, and as the method which would cause least strain and loss of blood I did a hysterectomy. Neither was the fact referred to that for the remaining months her temperature, as taken by the rectum, was normal which it had never been before. Later she developed an acute exacerbation and died very speedily some four months later. How much the pregnancy and the hyperemesis induced the rapid spread of the tuberculous condition I cannot say, but I think it is reasonable to suppose that her depreciated condition due to

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the vomiting was not the very best help to her recovery from her tuberculous condition.

Of renal cases there have been one in hospital and one in private to which I wish to refer. The one in private was of interest as the woman had a history of fever in childhood with a permanent albuminuria thereafter. She became pregnant with her first child and was delivered at the seventh month of a dead child after having had four convulsions. She was warned not to become pregnant again, but despite this she did and I saw her at the second month with her urine markedly diminished in amount and solid with albumen. I induced abortion in her case also, and I think with sufficient indication, but I mention it only with reference to the method employed.

Amongst the more unusual condition which come under indications I would mention two classes of cases, one in which I induced abortion and the other in which I did not. One was a woman who had suffered two years previously from sleeping sickness. The disease left her with permanent tremor and slow cerebration, but she was able to fulfil her household duties. She became pregnant and at the third month was sent to me for an opinion, as according to her doctor her mental condition was decidedly worse and her tremor was so increased that she was unable to perform her duties. A colleague saw her and was very doubtful about the advisability of interfering; a physician also saw her and was of the same opinion from the point of view that there was no reason why the child should not be perfectly healthy. The neurologist who had seen her during her acute state was of the opinion that her condition might become worse, and without being dogmatic was inclined to think that the pregnancy should be terminated. That was my own opinion. I procured abortion and I am glad I did, as it was noticeable, not only to myself and the nurses who were in attendance but even to the other patients in the ward, how much she improved, both in mental capacity and lack of tremor within the next week. The other nervous disease cases which I have seen have been two with definite signs of transverse myelitis without any apparent cause occurring during pregnancy, one at the fourth month and one at the eighth. In both cases the physician confirmed the diagnosis of the nervous side of the matter, and on my suggesting that I saw no reason why it might not be part of a toxæmia they agreed. I thought one might postpone doing anything obstetrical and see how the

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cases progressed. The case at four months improved under general treatment, had a normal delivery and a complete recovery, the nervous symptoms being practically absent by the time of delivery. The other, who was at the eighth month, progressed slowly until after delivery and then made a rapid and complete recovery in a matter of six months.

Finally, the only other indication I wish to refer to are those cases who are really affected mentally. These may be apparently hysterical in type, but it is very difficult to know where to draw the line. If it be a true mania or melancholia then I have no hesitation in inducing abortion for the woman's sake, but it is very difficult to gauge exactly what these patients mean by the wild threats of suicide which are sometimes indulged in. I have induced abortion in such a case where the woman had had five children in five years and her life from the time of her marriage had been one constant procession of pregnancies, labour, lactation, another pregnancy and so on. She was seen by two physicians and an alienist, who were all satisfied that she would carry out her threat to commit suicide if the pregnancy were not terminated. I induced abortion and incidentally a few weeks later sterilised her at the request of herself and her husband. Whether one should have performed that operation is perhaps a debatable point, but I felt justified after explaining the matter fully to both of them.

As regards the methods employed, these may be divided roughly into the slow methods and the rapid methods, the slow methods being used where there is no urgency for the evacuation of the uterus and the rapid where the woman's life apparently is in danger. In the slow methods dilatation and packing the uterus with gauze either with or without destroying the ovum by means of polypus forceps is the simplest way. It entails no shock and the patient usually discharges the abortion from three to five days after. It is the method that I have used in all my private cases when there was no need for haste. The only point in connection with it I would like to mention is that in practically every case a slight temperature develops during the twenty-four hours or so before the abortion is discharged. Whether this is a mild sepsis or not I am not prepared to say. The patients resume an absolutely normal temperature afterwards, but I have noticed the rise both in temperature and pulse before the abortion is discharged on practically every occasion.

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Next in order comes induction by means of tents, which I only used in one case. It is an extremely useful method where you wish to clear out the uterus at the end of at the most forty-eight hours, as the tents not only contribute to the dilatation by their own mechanical swelling but they seem to attract serum to the cervix and soften it to such an extent that dilatation by metal dilators to an extent to allow one finger at the very least to be admitted, is made much easier.

Of the rapid methods the first I would mention is vaginal hysterotomy, which has been performed altogether 21 times in the hospital. Of these, 13 cases were for hyperemesis with 5 deaths, a mortality of 38 per cent. At first sight this may seem sufficient to completely damn the operation, but one must remember that all these cases were definitely noted as severe. Five had jaundice and in every case the pulse had been over 100, so that I feel we cannot absolutely blame the operation as being the contributory cause to mortality when one notices in the eight other cases where it was done for varied indications there was no mortality at all.

There are two cases, however, which I think one should draw attention to, where unless there were circumstances which are not mentioned in the notes, it seems to me hardly a justifiable operation. These were two cases, one of inevitable abortion and the other a missed abortion, and in neither of these cases was there any increase in the pulse rate nor in the rise of temperature, nor as far as I can gather in the symptoms and signs detailed, any urgency for the uterus to be emptied by such a severe operative measure. In two cases abdominal hysterectomy was performed, one of these being the patient with phthisis to whom I have already referred and the other a debilitated woman who was distinctly affected mentally and had in addition several mentally defective children. The reason I did hysterectomy in the case which I personally treated was of course the conservation of blood as she was so anæmic, and also to make sure of sterility owing to her lung condition. The other rapid method of emptying the uterus is one which I think deserves more attention than it has hitherto received. It is abdominal hysterotomy. I first performed it in the case of a married woman whom I was called in to see with the usual signs and symptoms of red degeneration of a fibroid cyst of roughly the size of a cocoanut in the anterior wall of a two months' pregnant uterus. As it was the only fibroid I could

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feel and she was a comparatively young woman of 32 I decided to do a myomectomy, and having made the usual transverse incision through the capsule I enucleated the fibroid. It was not very difficult to remove, but as it was intramural, it had left a very very thin capsule towards the decidua of the pregnant uterus, and the handling necessary was such that I thought abortion was sure to occur. What was in my mind was that this would happen probably within forty-eight hours, and I did not like the idea of the uterus which was probably deficient in strength as the result of my operation and therefore the probability of poor expulsive power which could not be aided by abdominal massage owing to the wound. It occurred to me that one might empty the uterus at the same time, so I made a long incision into the uterus and was surprised at the way the ovum presented in the incision; it was shelled out of the uterus with the most consummate ease, and one could see the whole cavity so that if any parts had been left behind one could curette them away with absolute safety. I sewed up the uterus again and the woman had an uninterrupted convalescence. I have seen her several times since and the uterus appears to be perfectly normal, but she has not again become pregnant. I was so taken with the ease with which this operation was performed that I did it in another case which I have already referred to, that of interstitial nephritis in a second pregnancy where the woman had had eclampsia during her first with a long history of kidney disease, and the reason I did it there was that I considered that that woman for her own safety should be sterilised, and therefore if I was going to open the abdomen for that purpose it would be simpler to empty the uterus by that route rather than by inducing abortion by any of the ordinary methods and sterilising her later. Again I was surprised at the way in which the ovum presented and was so easily cleared out. In neither of those cases was there any hæmorrhage to speak of, but in another case where I assisted Dr Fordyce with a similar operation there was considerable oozing from the needle punctures in the wall of the uterus in the sewing up. Whether this was because she was in a more advanced stage of pregnancy I do not know, or whether it was due to the use of bayonet-pointed needles and that by using round needles this risk is minimised. To my mind the best indications for this method are cases, as I say, where sterilising of the patient is going to be carried out, after

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excision of degenerated fibroids, where in one's opinion the patient is certain to abort and finally in cases of Hydatid Mole. It seems to me probably the best method of emptying the uterus in such cases as one can actually see the whole cavity with such ease and at the same time look for lutein cysts in the ovaries. This operation was performed on one occasion I know in my absence at the Maternity Hospital by Dr Haultain, and he can give you better information as regards his opinion of its practical value in such cases. Theoretically it seems to me the operation of election.

Such shortly is a résumé of my experience of the last three years on this subject, and in conclusion I would like to say that although desirous, as we all are, of preserving intra-uterine life, I cannot think when it comes to a choice between the life of the mother and the life of the ovum it should require much time to decide which is the more important. From Professor Lyle's paper one would take it that his opinion is that the future child is the first thing to be considered, but statistics of our jails and asylums suggest that the unborn child instead of being a J. V. Simpson or a Lister may just as likely be a Crippen or a Charles Peace.

DISCUSSION.

Dr Fordyce said he believed that all abortions were illegal. He had not had much experience of vaginal hysterotomy. He was in the habit of teaching his students that it was dangerous to empty the uterus at a single sitting by ordinary dilatation, because of the amount of bleeding. He agreed with Dr Davidson that if the uterus could be emptied by abdominal hysterotomy that would be the safest operation of all. His one experience of that operation was not very fortunate. It was a bad case of aortic disease. He shelled out the ovum easily but could not stop the haemorrhage from the uterine wall and had to perform a hysterectomy.

Dr Douglas Miller said that abdominal hysterotomy was especially useful in cases in which sterilisation was also necessary. Apart from this operation there were three methods of dealing with such cases:— One could evacuate the uterus from the vagina and instruct the patient to report later for sterilisation; secondly, the uterus might be subjected to repeated curettage; thirdly, induction of abortion might be followed by exposure of the ovaries to X-rays. Each of these methods had its disadvantages. In the first case the patient did not, as a rule, report until she was pregnant again; in the second there was the danger of

Therapeutic Abortion

repeated operation in a woman who was usually a bad surgical and anæsthetic risk; the third method had obvious disadvantages unless the patient were near the menopause.

In discussing the technique of the operation of abdominal hysterotomy, Dr Miller quoted from four cases in which he had carried out this procedure. Organic heart disease had constituted the indication for the operation in two cases, toxic goitre in one, and recurrent severe albuminuric toxæmia in one. An occasional difficulty in the operation was the occurrence of troublesome bleeding, not so much from the incised wound in the uterus as from punctures in the uterine wall incident to suturing. He suggested that the finest curved intestinal rather than cutting needles should be used, and that the suture material should be the finest possible. It was advised that the superficial part of the wound in the uterine wall should be closed by the method of suture described by Piper of Philadelphia in Cæsarean section, the peritoneal edges being united in such a way that, when the operation was completed, there was no breach in the surface of the uterus and no puncture holes through which oozing might occur.

Professor Hendry said that in most of the cases mentioned by Dr Davidson—cardiac cases, nerve cases, phthisis cases—co-operation with a physician was essential, particularly in cardiac cases. In hyperemesis and nephritis, the treatment was absolutely in the hands of the obstetrician. The question of induction in hyperemesis was a difficult one, and to discuss one's experience would take a long time. The bad results from induction occur most often, because the cases have been allowed to go on too far before the treatment is carried out. With regard to sleepy sickness, he had a recent case in which a woman who had suffered from sleepy sickness two years ago, became pregnant. The mental symptoms which had disappeared became very severe, but fortunately she had a miscarriage. After the miscarriage, her condition improved very rapidly. Vaginal hysterotomy was a most undesirable operation in a primigravida. In a multipara it was an easier operation, and it was an operation on which one could depend upon emptying the uterus at one attempt and with one anæsthetic.

Dr Oliphant Nicholson said he had no doubt whatever about the necessity of inducing abortion in some cases of hyperemesis. In his experience there was very little danger about the actual induction of abortion. The anxiety one had about these cases arose from the fact that one generally postponed interference till grave symptoms appeared. Rapidity of the pulse, with a sub-normal temperature, was an ominous danger signal. He had had no experience of any rapid method of emptying the uterus; he had always allowed the uterus to expel the ovum naturally if possible, after packing ribbon gauze, by

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means of a canula packer, directly through the internal os. Sometimes it was necessary to dilate the cervical canal before using the packer. This was easily done with Fenton's dilators, or by means of a laminaria tent. Before attempting to empty the uterus of a missed abortion he had learnt by experience always to use one or more tents. When he had carried out the induction of abortion for grave hyperemesis at the proper time, in this cautious and slow way, he had never seen any serious results follow. He would like to confirm Dr Davidson's observation that a slight degree of temperature sometimes occurred during the time the gauze packing was lying in the uterus. He thought it might happen from iodoform gauze in certain patients, and now he used double cyanide ribbon gauze.

Dr Douglas M. Lindsay said he had seen a very successful operation of vaginal hysterotomy performed. The patient was a multipara with a questionable heart. Vaginal hysterotomy was done followed by sterilisation through the opening of the utero-vesical peritoneum. The uterus was cleared, the tubes pulled down and ligated.

The President thanked Dr Davidson for his paper and said that he was in entire agreement with most of what had been said. He did not, however, quite agree with Dr Davidson in his dogmatic teaching of the pulse rate as an indication for operation in hyperemesis. During his last term at the Maternity Hospital he had simultaneously two cases of hyperemesis gravidarum under his charge. One had distinct jaundice, albuminuria, and very considerable vomiting. Her pulse, when good, was between 130 and 138; when bad, it was as frequent as 170 per minute. This pulse rate was so alarming that it was felt that operation would be a very grave risk. However, in spite of treatment, the patient became gradually worse, and ultimately it was decided to evacuate the uterus. The position was explained to the patient, but she declared that she was a Roman Catholic and refused to consider the operation. The responsibility for continuing with medical treatment was thus on the patient's shoulders and the case became an intensely interesting "control." No manifestation of hyperthyroidism could be detected and ultimately, after two or three weeks' treatment with digitalis and quinidin, the pulse slowed to about 120. The vomiting stopped within thirty-six hours of the patient's declaring her determination to get better without operation. This case made one wonder how far tachycardia alone could be taken as a guiding symptom.

In the other case the patient was much less seriously ill clinically, but after a few days' medical treatment, she appeared to be getting worse and he was considering the possibility of evacuating the uterus. The patient meantime aborted spontaneously and incompletely. Under

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light anæsthesia the remains of the abortion were rapidly curetted out. The patient progressed satisfactorily for several hours and then quite suddenly died of heart failure after some twenty minutes' illness.

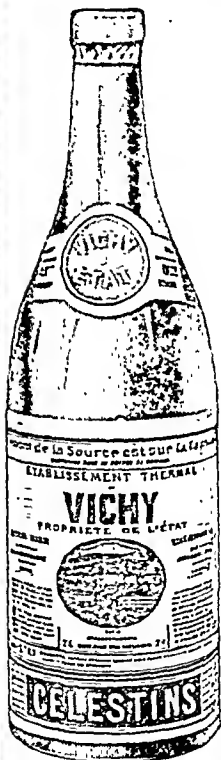
He did not agree with Professor Hendry's remarks that it was always helpful to call in a specialist on diseases of the heart or lungs or brain, as the case might be, before deciding upon the operation of induction of abortion. In his experience such specialists invariably advocated termination of the pregnancy, and their opinion might almost always be taken for granted in advance.

The President's experience of vaginal hysterotomy was exceedingly satisfactory in multiparous patients, but in primigravid women it was a difficult operation. He wholly agreed with Dr Fordyce that it was dangerous to induce abortion at one sitting by rapid dilatation of the cervix, especially in cases like hyperemesis gravidarum, where the patient was already much reduced in strength. The hæmorrhage which often followed was alarming, and the shock following forcible dilatation of the cervix profoundly dangerous. If one could get the uterus active beforehand and have the cervical canal converted into a simple ring, the operation was much more easy.

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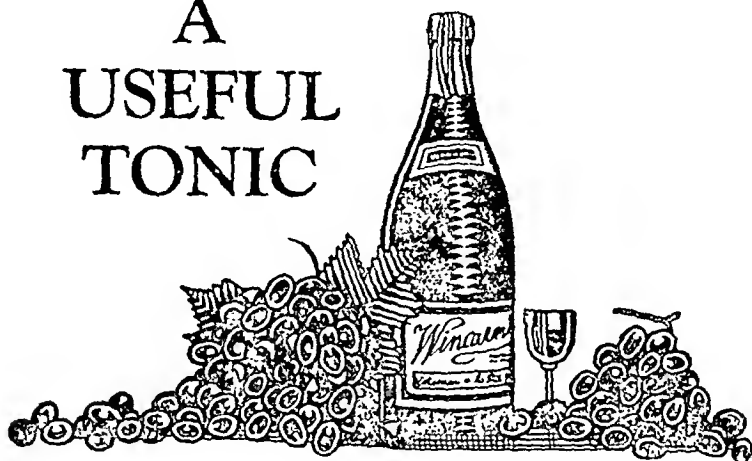
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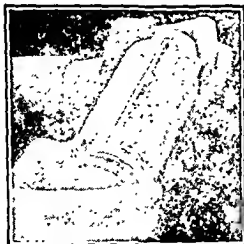
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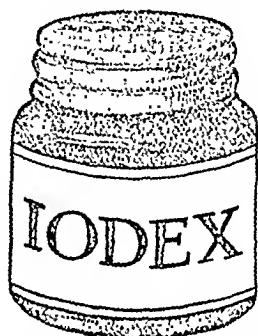


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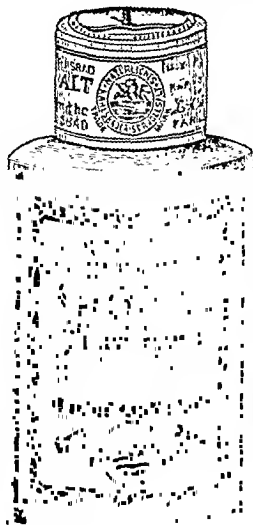


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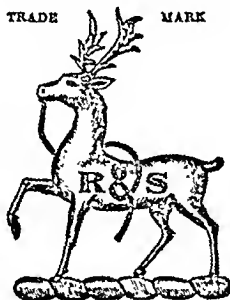
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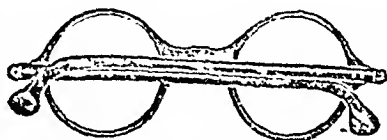
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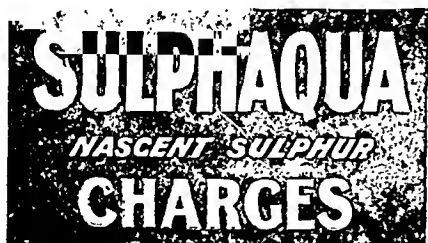
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Edinburgh Medical Journal

December 1927

ON THE PERSISTENCE OF COMPLETE WOLFFIAN DUCTS IN FEMALES.

By DAVID M. GREIG, C.M., F.R.C.S.E., F.R.S.E., Conservator, Royal College of Surgeons' Museum, Edinburgh; and GERTRUDE HERZFELD, M.B., Ch.B., F.R.C.S.E., Surgeon to the Royal Edinburgh Hospital for Sick Children and to the Edinburgh Hospital for Women and Children.

By one of those curious coincidences which few in the profession have not experienced, it has fallen to one of us (G. H.) to operate at a few months' interval on two unusually rare cases which presented great similarity in history, symptoms, and operative procedure.

CASE I.—A female child, aged 3 years, was brought to the Edinburgh Hospital for Women and Children, on account of vulvar discharge which had recurred since she was 9 months of age. Her family history, and her previous health, apart from the discharge, were unexceptionable. When a year old she had been examined on account of a similar vulvar discharge. No gonococci were found and under local treatment she had little trouble during the succeeding three months. Six months before admission the discharge had become more profuse and frequent and, it was thought, escaped more especially at stool and sometimes during micturition. For slight abdominal pain, particularly at night, during the past month hot fomentations appeared to give relief. There had never been vomiting or rise of temperature. The child was healthy and well developed. Examination under a general anæsthetic showed thin pus escaping from a small sinus situated apparently on the hymen at its superior attachment to the vagina. The flow could be increased by suprapubic pressure and an ill-defined tumour was felt in the right iliac region rising from the pelvis minor and ascending towards the costal margin. A few days later, again under general anæsthesia, a fine cannula was with difficulty inserted into the opening of the sinus, and 20 c.cm. of a bismuth emulsion was injected. An immediate radiogram (Fig. 1) showed a bilobed shadow starting distally from

David¹¹ M. Greig and Gertrude Herzfeld

a common apex. That going to the left of the sagittal plane had a definite rounded base; that going to the right of the sagittal plane had more lateral obliquity and its base was partly obscured by a tortuous



FIG. 1.—Radiogram of persistent right Wolffian duct, Case I., partly injected with bismuth emulsion, showing the bilobed retro-pubic shadow referred to in the text, and due to the geniculate bend of the terminal portion of the duct.

and convoluted prolongation which had been but imperfectly penetrated by the bismuth. The pus removed at both examinations was found to be sterile.

Operation.—The abdomen was opened by a right paramedian incision which ultimately extended from the pubic level almost to

Persistence of Wolffian Ducts in Females

the costal margin. In the Trendelenberg position the pelvic organs were found normal and a retroperitoneal fluctuating tumour passed from the base of the right broad ligament to the level of the kidney.



FIG. 2.—Radiogram of persistent right Wolffian duct, Case II., partly injected with bismuth emulsion, showing the tortuous canal passing over the pelvic brim towards the right kidney.

Incision of the peritoneum and reflection mesially of the cæcum and ascending colon exposed the tumour from whose postero-lateral aspect the adherent right ureter was with some difficulty dissected. The right ovarian vessels having been defined were ligatured and divided, and lest the uterine vessels should be injured the tumour was not followed to its

David M. Greig and Gertrude Herzfeld

distal termination but divided between clamps, and the distal portion cauterised, invaginated, and oversewn. Proximally the dissection showed that the tumour passed anterior to the right renal pedicle and terminated in the cellular tissue cephalad to the superior pole of the kidney. This area was temporarily drained through the loin and the abdominal wound closed. The child made an uninterrupted recovery, and when she reported six months later was in excellent condition and there had been no reappearance of vulvar discharge.

The tumour (Fig. 3) is a hollow viscus measuring 150 mm. in length and about 30 mm. in its maximum breadth. Its cut end near the bladder measures 20 mm. in diameter. The tumour consists of two masses of a convoluted tube bent into adherent loops very reminiscent of tortuous varicose veins. These masses have their long axes placed vertically and are connected by a narrow horizontal isthmus about 20 mm. long. At its pelvic extremity the tumour forms a geniculate bend. The wall of the tumour is congested and firm and its internal lining is smooth. Microscopically the wall consists of fibrous tissue with many inflammatory foci and very few polymorphs. It is lined by transitional epithelium and contains strands and bundles of plain muscle fibres arranged circularly and longitudinally.

CASE II.—A female child, aged 5 years, was admitted to the Edinburgh Hospital for Women and Children, a year after the child referred to in Case I., on account of recurrent vulvar discharge of three and a half years' duration, latterly accompanied by pain in the right iliac fossa. She had previously been in hospital at the age of $1\frac{5}{12}$ years because of an offensive purulent discharge which was presumed to be a gonorrhœal vulvo-vaginitis, though the presence of gonococci was extremely doubtful. After several examinations a gonococcus was thought to be recognised on one occasion. Eighteen months later she was readmitted with a recurrence of the discharge and repeated examination failed to find gonococci. She improved under local treatment only to be again admitted for a relapse after a comparative immunity of five months' duration. Recently pain in the right iliac region seemed to have raised some constitutional disturbance as no other cause was apparent. The discharge was very copious, and careful investigation under a general anæsthetic failed to disclose the source though it was definitely not vaginal. A catheter specimen of urine yielded a coliform bacillus in pure culture and was accorded an undue significance. A temporary improvement during a month was followed by an increased quantity of discharge. A further examination under an anæsthetic then disclosed a minute orifice on the floor of the urethral meatus slightly to the right of the middle line from which suprapubic pressure caused an exudation of thin pus. With more difficulty than in the previous case a little thin bismuth emulsion was injected through a cannula and a



FIG. 3.



FIG. 4.

Drawings of the two excised tumours, Fig 3 of Case I. and Fig. 4 of Case II., showing the general appearance of the tumours and their similarity.

Persistence of Wolffian Ducts in Females

radiogram (Fig. 2) showed a tortuous tube-like shadow beside the bladder passing over the brim of the pelvis. Through the failure of bismuth penetration its entire course was not indicated.

Operation.—Through almost the entire length of the right rectus abdominis muscle the abdomen was opened by a vertical incision. The peritoneal sac contained a little clear fluid. With the child in the Trendelenberg position and the viscera displaced to expose the posterior parietal peritoneum a sausage-shaped tumour was observed with the right ovary mesial and ventral to it. The peritoneum was incised lateral to the caecum and ascending colon, and these structures being reflected mesially the tumour was seen to consist of a thick tortuous tube distended with fluid. It was carefully isolated by blunt dissection. In the pelvis minor it passed downwards by the side of the bladder dwindling to the size of a piece of stout string and here it was ligatured and divided after the ureter, which was adherent to the postero-mesial aspect of the tumour, had been dissected off with some difficulty. Cephalad the tumour passed posterior to a short right renal vein and ended blindly at the superior pole of the kidney between it and the right suprarenal gland to which it was slightly attached. The terminal stage of the dissection was facilitated by puncture of the thin cephalad end of the tumour and the partial evacuation of its contents. After suturing the posterior peritoneum the abdomen was closed.

There was a good deal of sickness during the first thirty-six hours but the convalescence thereafter was uneventful.

The tumour (Fig. 4) measures 145 mm. in length and its greatest diameter is 30 mm. It is a somewhat convoluted tube composed of three superimposed dilatations with a blind cephalad extremity and a caudad extremity terminating in a minute opening. Its wall varies from 1 mm. to 2 mm. in thickness and its lining membrane is smooth. Microscopically the walls contain plain muscle fibres in two layers. The submucosa is infiltrated with chronic inflammatory cells. The mucosa is composed of transitional epithelium similar to that found in the urinary tract and does not show any pressure atrophy. Thickening of some of the blood vessels in the outer coat is the result of chronic inflammation.

Apart from the event in these two cases which is a matter for congratulation there are many points of striking similarity. Both cases were of female children between 3 and 6 years of age. The chief symptom in both was the persistence, with exacerbations, during years of an aseptic puriform discharge from a vulvar opening so minute as to be observed with difficulty only after repeated examination. Radiography after bismuth

injection showed the same tortuous shadow passing towards the right kidney and by operation retroperitoneal tumours of the same shape, character, structure, and size were removed. That each tumour was the remains of the right Wolffian duct appears to be the only possible explanation and seems to evolve naturally when the embryology of the parts concerned is taken into consideration.

Developmental considerations.—Early in the third week after fertilisation of the ovum the embryo undergoes division into primitive segments by symmetrical horizontal division of the paraxial mesoderm, and in relation to each segment or somite two or three tubules develop whose essential characteristic is their secreting power and they form the excretory organ of that particular segment. The tubules form as diverticula from the original coelomic cavity and are present from the cervical to the sacral region. The series cephalad to the mid-thoracic segment forms the pronephros, the more caudad series the mesonephros. That the products of their activity may find vent a cord of cells, later becoming hollowed into a canal, develops in the cervical region, and passes caudally uniting in its course with each set of tubules until in the fourth week of embryonic life it debouches into the cloaca. The pronephros with its duct atrophies and disappears, but the tubules of the mesonephros are more persistent and their duct becomes the Wolffian duct. The intermediate cell mass, of paraxial mesoderm, forms two ridges, the Wolffian laterally and the genital mesially. Each ridge has its own mesentery and these remain fused dorsally to form a common mesentery. The Wolffian ridge contains the Wolffian duct and a little later, ventral and mesial to it, the Müllerian duct. According to Keith²⁷ the tubules and the Wolffian ducts have reached the height of their development in the fourth week of embryonic life.

Caudad to the mesonephros the metanephros forms from the intermediate cell mass, or as Keith²⁸ maintains, the caudad portion of the mesonephros undergoes hypertrophy and is differentiated to form the metanephros which becomes the essential part of the permanent kidney, and as this develops during the third month the tubules and Wolffian ducts become less and less necessary as such and their functions are annulled or perverted; annulled with atrophy and disappearance if the embryo develops as a female, perverted to become the ductus deferens should it develop as a male.

Persistence of Wolffian Ducts in Females

The first sign of the permanent kidney according to Pohlman⁵⁵ is a dorsal outgrowth from the Wolffian duct close to the cloaca in a 4.5 mm. embryo and in a 5 mm. embryo this renal bud lies at the 2nd sacral vertebra, has lengthened and its blind extremity has become dilated. In the 7 mm. embryo the two kidney anlagen lie at the same level 50 microns apart and each consists of a segment, now surrounded by specialised mesodermic tissue, which will form the ureter and is capped by mesenchyma which will form the kidney proper. It is at this stage that the upward displacement of the kidney anlage commences and in the 14 mm. embryo the upper border of the kidney has reached the 3rd lumbar vertebra. The kidney lies behind the Wolffian body and the ureter is lateral to the Wolffian duct. By the time the embryo measures 20 mm. in length the ureteric outlet is quite separate from the Wolffian duct and opens by itself into the urogenital sinus. Regression of the Wolffian bodies has begun, according to Ballantyne,² in the fifth week of embryonic life. During the initial stages of the metanephros the pelvic ends of the mesonephros fuse to form the genital cord in which lie the Wolffian and more mesially the Müllerian ducts.

In the female when the ovary passes from the lumbar region to the pelvis it draws with it the Wolffian mesentery in which lie the Müllerian and Wolffian ducts. The mesentery itself forms the mesosalpinx; the Müllerian duct, the uterine tube; and in the adult the remains of the Wolffian duct are apparent as an ill-defined cord running in the mesosalpinx parallel to the uterine tube, as the ductus longitudinalis epoöphori. Sometimes in children, and much more rarely in adults, it persists further and reaches the side of the cervix gradually approaching the vaginal mucosa under which it passes to terminate by a small opening near, at the base of or at the free margin of the hymen, that is to say at the junction of the vagina with the vulvar cleft. The investigation carried out many years ago by Berry Hart⁶ convinced him that till the third month the vagina was entirely Müllerian and blind. Then at the caudad end of each Wolffian duct a bulb covered with squamous epithelium appeared and by proliferation of this epithelium the Müllerian vagina was filled up and the fornices and vaginal portion of the cervix marked out. The Wolffian bulbs coalesce and break down in the centre at the same time as the cells filling the Müllerian vagina break down and the normal squamous lined vagina

David M. Greig and Gertrude Herzfeld

is formed. The hymeneal opening is formed by the epithelial involution from the perineum meeting the distending Wolffian bulbs. "The Wolffian bulbs form the hymen and obliterate the lower ends of the ducts of the Wolffian bodies." The ducts of Müller, he says, determine the site of the vagina, the Wolffian ducts supply its lining and form the hymen. That the vagina is obliterated there is no doubt, but there is a difference of opinion as to the source of the cellular proliferation which obliterates it, perhaps the majority to-day believing that it originates, not from the Wolffian bulbs as Berry Hart thought, but from the ends of the Müllerian ducts themselves. As Wood-Jones⁶³ has pointed out, the differentiation of rectum, vagina, and urethra is not a question of septa formation but that the vagina is at one time an active solid downgrowth of tissue which later becomes canalized, and that the source of the epithelial masses described by Berry Hart is still uncertain.

The terminal portion of the Wolffian tube is known as the paravaginal portion or Gärtner's duct. Between the ovary and the obliterated tube a series of radiating tubules—the epoöphoron—represents the remains of the Wolffian tubules or secretory part of the Wolffian body (mesonephros). The paroöphoron is stated by Nicholson³² to be by no means a functionless structure; and indeed a functionless inutility could scarcely be expected seeing that the organ continues after birth to develop, according to Keith,²⁹ until the thirty-fifth year and according to Cole¹⁴ until the fortieth to fifty-third year of adult life. Until late in adult life, then, the paroöphoron retains some potentiality of growth. As regards the Wolffian duct itself, Keith²⁹ holds that the Wolffian remains along the ovarian fimbria and the ligament of the ovary are the usual source of cystic formations. From our point of view it is important to note that there is thus proof that portions of Wolffian duct sequestered in the course of obliteration may continue to secrete, enlarge, and to form cysts.

In the female the Wolffian duct is under normal conditions but temporary. The essential permanent structures are the Müllerian ducts, whose proximal portions remain apart as the uterine tubes communicating with the peritoneal cavity through the ostia abdominale, and whose distal portions fuse in the genital cord to form the uterus and vagina.

From the distal end of the Wolffian duct close to its opening into the cloaca a diverticulum appears during the fifth week of

Persistence of Wolffian Ducts in Females

embryonic life and is the forerunner of the ureter. As it elongates to form the permanent duct, the renal pelvis, and the collecting tubes, it is capped by the nephrogenic tissue of the metanephros which forms the secreting portion of the kidney. This developing structure lies dorsal to the mesonephros and makes its way from the hollow of the sacrum to the 2nd and 3rd lumbar segments. With the separation of the ureter from the Wolffian duct in the seventh week, when it comes to open separately into the urogenital sinus, the kidney and its duct gain their ultimate individuality. A Wolffian duct persisting in the female in its entirety will extend from its orifice in the neighbourhood of the hymen upwards behind the broad ligament, retroperitoneally, ventral to the ureter towards the superior pole of the kidney where it will terminate in the tissue between the kidney and the suprarenal gland. This is exactly what has occurred in the two cases which form the subject of this paper. If any remnant of a duct occurs beyond this it must be a relic of the pronephros and the superior end of the kidney is—as Keith points out—where such a relic is found.

At the caudad end of each Wolffian duct certain factors add complexity. That remains of the paravaginal portion of the duct are not uncommon was proved by Kocks,³⁰ who found in 80 per cent. of women two small openings close to the posterior border of the urethral orifice which led into a canal 5 to 20 mm. long. These he considered to be the blind ends of Gärtner's ducts, and the little papilla on which these opened he considered analogous to the male crista urethralis. From the distal end of the paravaginal portion of the Wolffian duct the outgrowth of a sacculated diverticulum forms Schüller's gland, the homologue of the vesicula seminalis of the ductus deferens in the male, and if the terminal portion of Gärtner's ducts persists these glands may also exist and may account for one variety of watery vulvar discharge. These openings are to be distinguished from two small openings which lie just within the meatus urinarius in the female. These were first described by Skene⁴⁸ who found them invariably present in more than a hundred women. The canals of which they are the termination run parallel with the urethra for 8 to 20 mm. In young subjects the openings are found further up the urethra than in older women, in whom relaxation of the parts with slight urethral prolapse makes them appear at the meatus. They are known as Skene's ducts or tubes, or

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better still as the ductus para-urethralis; and though many years ago Bland-Sutton⁷ referred to "the terminal orifices of Gärtner's ducts, which have become familiar as Skene's tubes," the more modern consensus of opinion probably gives them a specific existence. Routh⁴¹ says that Gärtner's ducts "may in a few cases really open into Skene's tubes and be a source of obscure albuminuria." In Case II, as recorded above, the tiny opening of the tubular tumour was found just within the meatus urethralis, and such a connection as Routh mentions explains what would be a very unusual site for the opening of the Wolffian duct.

If then the Wolffian duct has, during development, been drawn down towards the pelvis about the seventh week of embryonic life, it has again been carried upwards with the development of the permanent kidney in its translation to the level of the twelfth rib. There is a possibility, however, that the Wolffian mesentery has been unduly separated from the genital mesentery, that they have not retained their mutual connection towards the posterior wall of the abdomen. If this were so the Wolffian duct would be less or altogether un-influenced by any changes the genital gland might undergo as regards its position. The Wolffian duct might thus retain its position attached cephalically to the tissue cephalad to the metanephros, that is to say at the superior end of the kidney. If this hypothetical complete separation of the genital from the Wolffian mesentery occurred, it would still leave the Müllerian alongside the Wolffian duct in the tissue of the Wolffian ridge and both ducts would share the same mesentery. It might be expected, therefore, that the derivatives from the ducts would be mutually affected by any disturbance in site or in development. But clinically no disturbance of the Müllerian duct has been recognised, and the uterine tube and uterus are apparently normal in every respect and bear their normal relation to the ovary. It may be, however, that some cleft of the paraxial cell-mass of the Wolffian ridge has provided a separate mesentery for the Wolffian duct and for the Müllerian duct. The normal concert of their subsequent development would thus be disturbed, and the right Wolffian duct being the later perhaps in its formation as Schwarz⁴³ and Baumm⁴ say Dohrn and Rieder have established it to be in its retrogression, an abnormality would be more likely to be unilateral than bilateral and more likely to occur on the right side than on the left. Such a supposition, extremely difficult

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to prove, would time the initial disturbance which might culminate in a persistent Wolffian duct reaching from the hymen to the suprarenal region at a very early period in the development of the embryo, about the end of the second or beginning of the third week. Perhaps the absence of Müllerian influence may have favoured Wolffian persistence.

Histological features.—In structure a Wolffian tubule as Duthie¹⁷ states is a cylindrical tube lined by a single layer of regular cubical epithelial cells resting on a basement membrane which is immediately subjacent to a longitudinal coat of plain muscle fibres, and this in turn is surrounded by an investment of plain muscle fibres arranged circularly. A vascular fibrous connective tissue sheath surrounds the whole. The Wolffian duct has a similar structure but is larger and its muscular coats are thicker. In no case did Duthie find the epithelium ciliated. This is the more significant as her research was carried out for the most part on foetuses and young children, though adult and even old women were not excluded. Many would have us believe that cilia are distinctive of Wolffian epithelium. Thus Petridis³⁵ writes that one of the characteristics of cysts of the Wolffian duct and of Gärtner's duct is that they are lined by ciliated epithelium. Assuredly this is not always the case. As Silhol and Bourde⁴⁶ point out the lining of these cysts may be histologically cylindrical or cubical epithelium which may or may not be ciliated. It is conceivable that late in life cilia in a persistent duct might be lost, but Duthie's investigations point to its non-existence or its early disappearance.

In the tubules the muscular coats degenerate with age and are replaced by white fibrous connective tissue, between the fibres of which are a few plain muscle cells. This is confirmed for the most part by Fleming¹⁸ who found the tubules in a four months' female foetus sinuous, cylindrical, and lined with a single layer of cubical epithelium with large deeply staining nuclei. The tubules were surrounded by a condensation of primitive connective tissue cells, an inner coat of longitudinal cells and an outer coat of circular cells. One of the lateral tubules was of a larger lumen and had a thicker connective tissue wall and was the remnant of the Wolffian duct. "No muscle cells are seen in the walls of the Wolffian tubules or of the duct," the writer says, but surely the longitudinal and circular coats of cells found in all the tubes must be the forerunner of the muscular coats found by other observers.

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The embryological, anatomical, and histological facts which have just been detailed make it impossible to consider the tumours successfully removed from these two female children as other than right Wolffian ducts. Their anatomical site, characters, relations, and termination at either end conform only to a persistent Wolffian duct while the histological examination adds additional confirmation.

Even if very rare such a striking tumour could scarcely escape attention, and the likelihood that it might be mistaken for a supernumerary ureter suggests itself and investigation of the literature on the subject seems to confirm this. It must be remembered how close a relationship a persistent Wolffian duct must bear to the permanent ureter which indeed arises as a bud *from the distal end of the Wolffian duct*. The cephalad or proximal end of the duct, however, never joins the kidney or renal pelvis but ends sometimes by a filiform extension, sometimes as a sort of cystic dilatation in the tissue between the kidney and the suprarenal gland. Where the duct has ended superiorly in a cystic dilatation it has been presumed that this is a degenerated or abortive additional kidney, and confirmation has been claimed by the finding of some glomerular-like structures in the wall of the cyst. It must not be forgotten, however, that the Wolffian tubules for whose secretion the Wolffian duct provides escape have essentially a glomerular structure, and the discovery of a few more or less ill-formed glomeruli in the cyst wall need not be proof that the cyst wall is renal cortex but may be evidence of the remains of Wolffian tubules.

Discrimination from an abnormal ureter.— It is not necessary to consider the various abnormalities of the ureters which, according to Herbst and Polkey,²⁶ are equally common in the sexes. A classification of such abnormalities has been made by Pohlman.³³ But from the literature of the subject may be culled many cases of so-called duplication of the ureter in which the extra canal conforms rather to a persistent Wolffian duct than to an adventitious ureter. It is difficult to accept as an extra ureter a tube which is not connected with the renal substance nor with the renal pelvis, has no communication with the ureter and does not open into the urinary bladder. The sacculated cystic tumour which a persistent Wolffian duct may form must have suggested to every observer a similarity to the dilated and sometimes tortuous expansion which a ureter, and

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particularly an accessory ureter, may undergo as a result of defective innervation. Cases of ectopic ureteral openings have been collected by Secheyron,⁴⁵ Schiwarz,⁴⁴ and others, and since the days of Civiale¹³ many individual experiences have been reported. The opening may occur in the vagina, at the vulva, in the urethra, and even in the rectum. Its presence is, as a rule, characterised by incontinence of urine which, according to Caspari,¹² may be only diurnal. This function at once distinguishes an abnormal ureter from a persistent Wolffian duct in which the discharge complained of never simulates urine. Some of the reports lack clarity and seem biased by some preconceived explanation, a fault by no means restricted to the literature of Wolffian ducts. The point may be illustrated by selecting a few examples. Orthmann³¹ reports the case of a female, aged 27, in whom a swelling between the labia which had increased since it was first noticed at the age of 15 years was found on operation to lead to a hollow stalk with thick walls. The cyst contained "urine," but no urine continued to flow from the opening after the cyst had been evacuated. Along this canal in the direction of the left kidney a sound could be passed up to its handle. The author considered the case one of a bifid ureter, but obviously it might as easily be a persistent left Wolffian duct which at its distal extremity had ended blindly. Haushalter and Jacques²⁴ emphasise that a "supernumerary ureter" may in women lose itself in the neighbourhood of Gärtner's duct, and it is common knowledge that an imperforate Gärtner's duct may form a vaginal cyst. Such cysts are often mistaken for cysts of the greater vestibular glands. Guibal²² reports the case of a nullipara, aged 35, in whom vague vesical symptoms with renal crises accompanied by abundant leucorrhœa led, after a futile treatment for cystitis, to the diagnosis of salpingitis. A median coeliotomy showed an elongated cystic retroperitoneal tumour extending downwards between the layers of the right broad ligament. It was dilated to the size of the thumb, was contorted and folded on itself, and was adherent to the bladder below. Its cephalad relations were not noted at the operation. Ischuria with uræmic symptoms of five days' duration followed the interference though no attempt had been made to remove the tumour. This is no proof, however, that the operation was on the urinary passages for on two occasions thirteen years previously the administration of chloroform in connection with

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a fracture of the leg had been followed by a four days' anuria. Cystoscopic examination *after* the coeliotomy showed a normal bladder and normal ureters with normal urine escaping from them. Later the swelling was punctured per vaginam and 250 grams of discoloured "urine" evacuated and a solution of methylene blue injected. Sixty hours later blue urine was observed coming from the right ureter, a sign of absorption probably, not of communication. Had the cystic swelling opened into the ureter or the renal pelvis methylene blue should have taken minutes, not days, to appear in the urine. A further vaginal operation established a permanent fistula which was present a year later in association with chronic uræmia. Surely in this case the findings are more compatible with a persistent Wolffian duct than with a supernumerary ureter.

One other case may be worth mentioning in this connection. It is one reported by Allenbach, Boeckel, and Franck,¹ and concerns a woman twenty-seven years of age in whom recurrent abdominal pains and intestinal symptoms led to a coeliotomy which disclosed on the left side a subperitoneal fluctuating tumour 100 mm. in length extending from the bladder upwards to the mesosigmoid. It was presumed to be a dilated ureter and the abdomen was closed. Cystoscopic examination on the following day showed a normal bladder and normal ureteral openings. The ureteral catheters passed normally and from each kidney obtained normal urine. A few days later with a copious vaginal discharge the temperature fell to normal and she remained well for seven months. Recurrence of pain then led to the discovery of a fluctuant mass in the anterior vaginal fornix which discharged on the following day through an opening in the mesial plane 80 mm. from the vaginal orifice. Dilatation of the opening evacuated a quantity of yellow pus. Radiographed with a ureteral catheter *in situ* a convoluted cyst was seen passing towards the superior extremity of the left kidney. There was no communication with the ureter. A few weeks later the kidney was exposed by the lumbar route, and as difficulty was experienced in detaching the "supernumerary ureter" from the superior pole of the kidney, part of the kidney was excised with the structure which was easily freed from the normal ureter as far as could be reached. Five days later the temperature rose, and vaginal examination showed that the "fistula" had closed. This was reopened with

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immediate relief and about a month later the distal portion of the "ureter" was excised with satisfactory and permanent relief. Examination of the excised superior part of the tumour showed that it terminated about 20 mm. from the renal parenchyma, and that it was attached to the renal capsule by an intermediate fibro-fatty tissue. Histological examination of the cyst showed that its epithelial lining had been shed and abundant evidence of inflammatory changes in its wall. In the fibro-fatty tissue there were vestiges of renal tissue in the shape of glomeruli and groups of dilated tubes filled with colloid. It has been pointed out by Plisson and Grandelaude³⁶ that there exist in the Wolffian body (mesonephros) epithelial tubes embedded in a special embryonic tissue called the Wolffian blastema containing mesenchyma and epithelial elements ill-defined in their mutual relations, a description which is strikingly applicable to the histological findings of Allenbach, Boeckel, and Franck, and emphasises that glomeruli and tubes are not necessarily renal (metanephros) derivatives.

Persistent Wolffian duct in the female.—Whether the cases referred to in the preceding section are acknowledged to be examples of persistent Wolffian ducts or not, there are others in which no such doubt exists and in which the authors have generally assigned a Wolffian origin to the tumour. In comparison with the older writers modern authors may arrogate to themselves new theories of explanation but few dare claim increased powers of observation. It would be strange, therefore, had the masters of the past failed to note so striking an anomaly and but natural that they should have looked upon the structure as an adventitious ureter. The ascription of the peculiarity to duplication of the uterine tubes was made in the sixteenth century by Realdus Columbus¹⁵ from personal observation of the dissection of a female. The uterine tubes, he states, were divided and instead of two, Nature had provided four. The two larger went to the uterine cavity; the two others went to the root of the clitoris ending in an opening near the urethral meatus. The uterus was normal and the ovaries were large. Like so many of the older records this one lacks detail.

There is little difficulty in recognising a partially persistent right Wolffian duct in the case which Secheyron⁴⁵ quotes from Ozenne (1880) as occurring in a female, aged 60 years. A hollow retroperitoneal viscus lay ventral to the right ureter and terminated cephalically by a twisted imperforate cord attached

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to the tissue cephalad to the superior pole of the kidney, and caudally by a similar imperforate strand of tissue to the uterus immediately above the reflection of the vaginal mucosa. At its largest the tumour was the size of the thumb, of irregular calibre, and with a smooth internal surface.

An unusual cyst of Gärtner's duct is reported by Watts⁶² as occurring in a viii-para, aged 41. It was tapped and then excised and a probe could be passed along it "for several inches" towards the left side. The cyst wall was composed of an outer fibrous connective tissue layer, a middle, muscular layer, the outer fibres being arranged longitudinally and the inner circularly, and an inner layer of fine connective tissue from which the lining epithelium had been lost. He points out that the structure corresponds exactly with the ductus deferens in the male and that even its contents showed some similarity!

In 1888 Debierre¹⁶ reported that a female in whom the vagina and uterus were double and in whom there was a supplementary spleen, presented in the thickness of the broad ligament a well-developed epoöphoron at the mesial side of which a collector canal followed the direction of the uterine tube to the lateral aspect of the uterus as a duct of Gärtner, which though it had undergone partial atrophy and was not of uniform calibre had not entirely disappeared.

A very interesting case was recorded in 1895 by Routh.⁴¹ It was that of a primipara, aged 30, in whom from a small opening on the vesico-vaginal septum just to the right of the mesial plane a continuous drop by drop discharge led to the daily evacuation of about two ounces of a pellucid albuminous fluid, of sp. gr. 1026, containing some sodium chloride but neither urea nor ureates. A fine urethral bougie passed its whole length along the canal towards the right kidney. By a plastic operation the orifice of the canal was deflected into the urinary bladder with the result that the vaginal discharge ceased, but she had acquired a permanent albuminuria.

Routh⁴² refers to an observation by Lawson Tait which is interesting as showing how the significance of this condition may be misunderstood. It was that of a female, aged 60 years, who had had a recurring clear watery discharge from the vagina during thirty years. On examination two minute openings were found one at either side of the urinary meatus. Temporary closure by cauterisation caused much pelvic distension and discomfort until the discharge re-established itself. No further

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operation was done and the discharge was continuing ten years later. Routh's paper particularly deals with vaginal cysts which communicate with broad-ligament cysts, and we can but endorse his conclusion that they are of Wolffian duct (Gärtner's duct) origin.

In Tandler and Halban's atlas⁵⁰ there is figured a partial dissection of an adult female showing a supernumerary left "ureter" which originated mesial and cephalad to the left renal pelvis by a bladder-like cyst about the size of an apple. Its wall was on the whole fibrous. It was subdivided by septa and at the superior pole of the sac there were a few tissues like kidney substance. The structure was as thick as the little finger and had several twists. It entered the vesico-vaginal septum and passed in it as far as the introitus vaginæ where it ended blindly. The uterine artery crossed ventral to this structure and to the ureter and continued to the cervix at the usual place. It is regrettable that the description is so inadequate and that there is no histological report.

In 1924 Madier³¹ removed from the left hypochondrium of a child aged 2½ a retroperitoneal, thin-walled polycystic tumour which he and his co-adjutor Nathan considered to be of Wolffian origin. It was lined by a single layer of large cubical epithelium with numerous secreting cells. Though most of the wall appeared fibrous one portion examined showed the structure of a Wolffian duct, namely, a lining of unstratified cylindrical epithelium surrounded by a muscular and a connective tissue coat. In the contents analysis demonstrated sodium chloride 5 grm. and urea 0.67 grm. per litre and traces of cholesterine and albumin. In this case the situation is somewhat unusual, but Silhol and Bourde⁴⁶ give a great variety of sites where Wolffian cysts may be found of which abdomino-lumbar is not the least common.

From a very stout female, aged 36 years, the subject of faint turns and attacks of diarrhoea, Forster²⁰ excised a large retroperitoneal cystic tumour from the left mesogastrium. The kidneys, ureters, and bladder were normal. The cyst was connected superiorly with the fatty capsule of the kidney. It was thin-walled and somewhat lobular and measured 150 mm. in diameter. It contained a yellowish fluid. The wall was 1 to 2 mm. in thickness, smooth, greyish white, and dense. The lining epithelium was of the high cylindrical type and was finely ciliated. Outside the basement membrane the connective tissue contained plain muscle fibres arranged in bundles.

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Finally, reference may be made to the case of an adult female, the report of which by Bloomfield⁹ is somewhat ambiguous, lacks accuracy and omits many essential facts. The chief interest is the size of the external opening which, placed a little to the right of the mesial plane, was large enough to admit a catheter (size not stated) into a canal which passed upwards and to the left for "some 3 or 4 inches." At a corresponding spot on the opposite side a small depression indicated the termination of the left Gärtner's duct.

These cases in conjunction with ours leave no reasonable doubt as to the existence of retention cysts due to persistence of the Wolffian duct in the female. It is a Wolffian extension of the much more common Gärtner's duct of the mesonephros. It is more common on the right side and may require investigation at any age. Incidentally these cases form a plea for the most minute and careful examination, repeated again and again if necessary, in all cases of unexplained vaginal discharge. Where the Wolffian duct is blind distally a tumour may be the only feature, but if there is an opening the characteristic is discharge. Should the opening be of adequate size the Wolffian duct seems to remain unchanged, but should the opening be too small or subject to recurrent obstruction the Wolffian duct becomes hypertrophied and tortuous, and even without infection its walls may thicken from inflammatory (reactionary) changes. The plain muscle in the duct walls will be under autonomic control, and in some cases perhaps the dilatation and hypertrophy may, like certain cases of congenital hydro-ureter, result from a neuromuscular defect or inco-ordination.

Persistent Müllerian duct in the male.—It is not possible to leave this subject without some reference to the corresponding condition in the male. The Wolffian duct has up to a point the same development in the two sexes, but whereas after that it is only abnormally present in the female subject, its persistence is essential to the male. It forms the canal of the epididymis, the ductus deferens, and the common ejaculatory duct, and by a diverticulum from it the vesicula seminalis. In the male it is the Müllerian ducts which normally disappear. They are later in development than the Wolffian ducts and open into the urogenital sinus late in the third month. We have seen each Müllerian duct in the Wolffian mesentery and followed it to the genital cord where it lies mesial to its

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corresponding Wolffian duct. The Müllerian ducts fuse at their termination to form the prostatic utricle, the homologue in the male of the female uterus. This tiny structure whose opening on the colliculus seminalis is a feature of the prostatic urethra lies in the mesial plane, while lateral to it on each side opens the ejaculatory duct. Like the Wolffian duct the Müllerian duct in its early stages extends cephalically as far as the superior pole of the mesonephros, that is to the third lumbar segment. The Müllerian duct lies ventral to the Wolffian duct and mesial to it towards its caudad termination. It is therefore between the superior pole of the kidney and the prostatic utricle that the persistent duct may be found or part of it may exist. Persistence of the Müllerian duct in the male is not fraught with the definite symptoms arising from a persistent Wolffian duct in the female. Such discharge as may exist escapes into the prostatic urethra whence it gains the bladder or adds moisture to the urethra to no appreciable extent. As in the female, aberrant ureters may exist in the male, but incontinence is not a feature in the rare cases in which a ureter opens into the prostatic urethra or into a seminal vesicle. As in the female the persistent Wolffian duct, so in the male the persistent Müllerian duct seems to have been often mistaken for an accessory ureter. In the two sexes the same distinctions hold good, the persistent ducts are not connected with the parenchyma of the kidney, do not communicate with the renal pelvis nor with the ureter, and they do not convey urine.

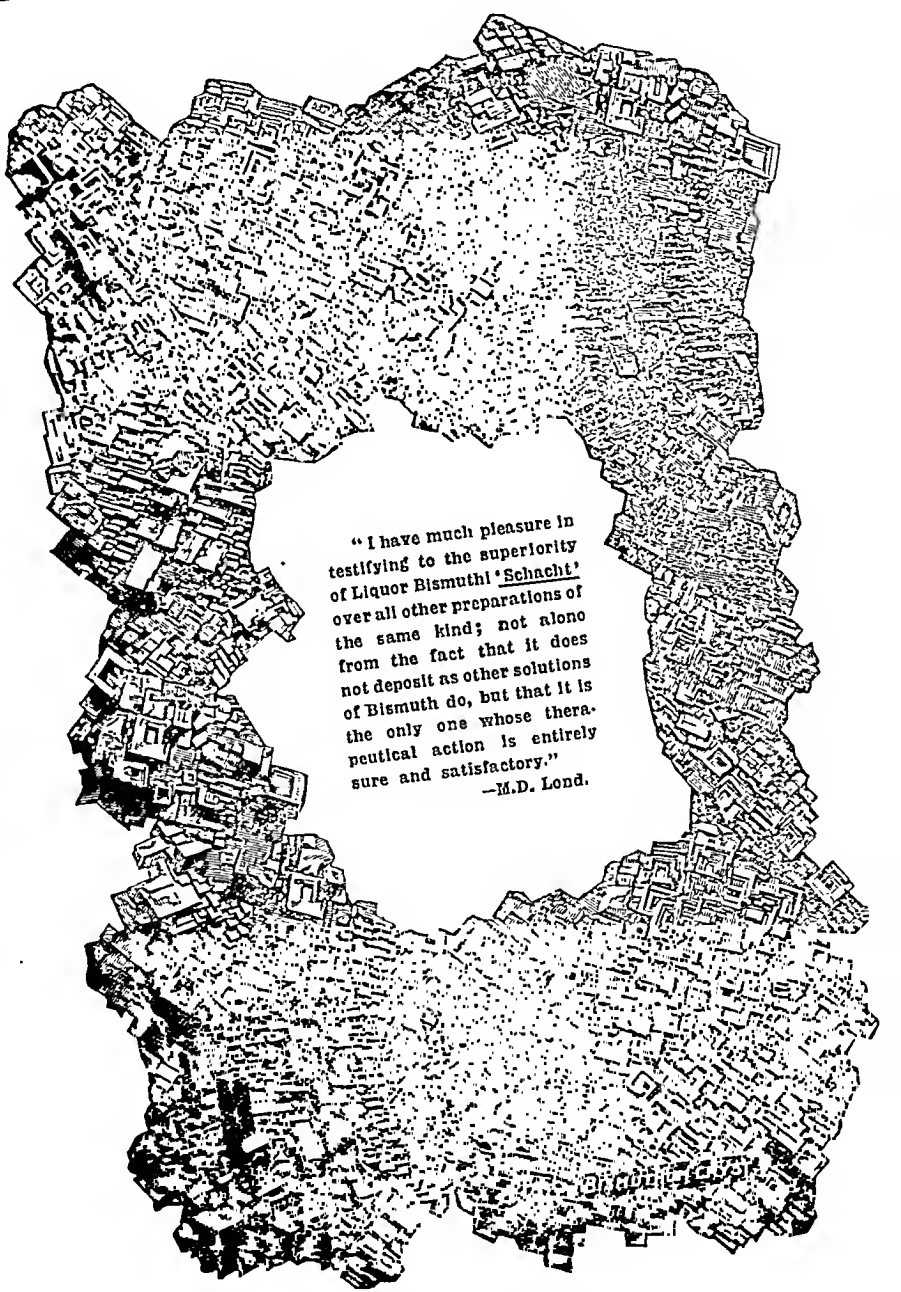
Ectopic ureteral openings, according to Herbst and Polkey,²⁶ occur with equal frequency in males and females. There is no particular reason why an abnormality of the Wolffian duct may not occur in the male, and doubtless this occurred in the case recorded by Gruber,²¹ where in an adult male with an ectopic right kidney and the right ureter opening into the right seminal vesicle, there was an absence of the right half of the trigone. The trigone is of Wolffian origin (Nicholson²³) and as such is subject to tumours alien to the rest of the bladder (Harris²³). But no extensive abnormality of the Wolffian duct can exist in the male without great abnormality of the corresponding cord and testis. This was the reason why Schwarz⁴⁴ (who quotes the case) and Förster decided that a defect reported by Thiersch could not be Wolffian as Thiersch thought, because the testis, seminal

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vesicle and cord of that side were well developed. Similarly in the case of an adult male, reported by Herbet,²⁵ where a 32 mm. long diverticulum arose 30 mm. from the distal end of an otherwise normal right ureter, the presence of a normal cord and testis negated the possibility of the diverticulum being remains of the Wolffian duct though it was attached superiorly by a fibrous cord to the tissue in the lumbar region.

In discussing imperforate and supernumerary ureters Haushalter and Jacques²⁴ quote Lilienfeld's case of a man, aged 65, who died of enteric fever. On post-mortem examination from the superior extremity of the right kidney which was profoundly altered an accessory "ureter," dilated in places, passed to the bladder wall where it ended as a cyst filled with dirty brown watery fluid prolonged by a triangular part the apex of which reached as far as the urethral crest. This too meagre description does not exclude the possibility of the structure being a persistent Müllerian duct and not an accessory ureter.

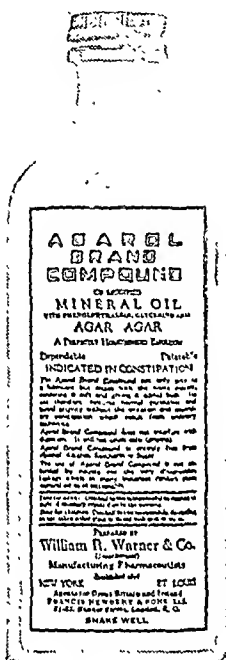
There is no lack of evidence that the Müllerian ducts may persist in man, and the evidence is incontrovertible. Sir J. Y. Simpson⁴⁷ in his monograph on Hermaphroditism states that Harvey found in one embryo a double uterus with two testes and a diminutive penis and some traces of prostate gland. A uterus and vagina opening into the prostatic urethra in a male is figured by Förster⁴⁹ in his atlas. In 1888 Stonham⁴⁰ reported the case of a boy aged 9 years who had a right oblique inguinal hernia with retained testes. The sac contained a uterus with uterine tubes and genital glands which proved on examination to be testes placed in the normal position of ovaries in the broad ligaments. On dissection after death the uterus was found to lead into a vagina which opened into the prostatic urethra at a well-formed prostate. Practically the same condition but without a hernia was found by Bland-Sutton⁸ in an eight months' male foetus which he dissected, the uterus being much in evidence between the bladder and the rectum. In operating on a childless male, aged 28, for a tumour at the site where an operation for left inguinal hernia had been performed at the age of 16 years, Banks³ found in association with a poorly formed testis a structure which Keith stated could only be from fusion and persistence of the Müllerian ducts forming a prostatic utricle of unusual persistence and size.



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These cases are evidence that the Müllerian ducts may persist in the male and may even undergo considerable evolution more or less in their normal positions; but as it is with the Wolffian duct so it is with the Müllerian that one or both may retain the embryonic position and extend from the normal distal termination to the perinephric or supranephric tissues.

An early paper and one in which the Müllerian duct origin of the tumour was maintained is that of Boogaard. We have been unable to consult the original publication, but have learned from a synopsis of it by Pouchet¹¹ that the condition was found on post-mortem examination of a man, aged 66, who died of nephritis. The right kidney was rather larger than the left. Mesial to each ureter was a rather larger convoluted retroperitoneal tube, the cephalad extremity of which had neither pelvis nor calyces but ended the one above the right kidney in a point, and the other above the left kidney in a rounded extremity. Distally these tubes were closely incorporated with the ureters but did not communicate with them, and they opened in the mesial plane of the posterior wall of the prostatic urethra by separate openings and there was no prostatic utricle. Boogaard says that the left tube being at least double the size of the right reminded him of the unilateral inequality of the development of the Müllerian ducts in the females of certain birds.

Two years later (1879) Remy⁴⁰ reported the case of an ill-nourished and neglected boy aged 6 years. Since "brain fever" fully a year previously the boy had had difficulty in micturition, the urine coming only in drops and evacuation of the bladder contents being incomplete. Dilatation of the bladder caused pain and abdominal distension. Catheterisation was easy and gave great relief and had to be continued during the month which elapsed before his death, which was preceded by rigors, diarrhoea, and rise of temperature. Post-mortem examination showed bilateral nephritis with tortuous dilated ureters. In front of the right ureter there was another canal, more straight, very regularly cylindrical and so like a ureter as to be easily mistaken for it. It did not communicate with the kidney but originated in a slender extremity at the level of the right suprarenal gland where it appeared to be related to a small group of transparent cysts in which it was easy to recognise a remnant of the Wolffian body. From this origin

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it rapidly enlarged, was adherent to the renal pelvis, then to the ureter which it covered, and at the termination of the ureter it passed under the base of the bladder perforating its wall to run under the mucosa which it raised up and it terminated by opening into the prostatic utricle by an orifice which admitted without difficulty a large sized stylet. The canal contained a white milky fluid not unlike the purulent urine which filled the bladder and ureters. The vesical symptoms had been due to obstruction caused by the raised mucous membrane in the prostatic urethra. The bladder was hypertrophied and showed ecchymoses and chronic catarrh. Both testes were well formed and on each epididymis there was an appendix. Remy maintains that this retroperitoneal tubular structure from its position, its course and its termination could be nothing else than a persistent right Müllerian duct.

In an adult male who died of uræmia Reliquet³⁹ found a left calculous pyelonephritis. The right kidney and ureter formed a single hydronephrotic cavity, only one part presenting a thin layer of renal tissue. Superior and mesial to the right kidney and not communicating with it a cystic structure was found which passed as a cord to the postero-inferior aspect of the bladder. It had something of the appearance of a supernumerary ureter alternately dilated and contracted. Distally it ended in an abnormal pocket near the trigone and opened into the posterior urethra on the urethral crest mesial to the orifices of the ejaculator ducts. This abnormal structure was filled with a dark fluid which had been recognised as passing at intervals with the urine. To pressure by this abnormal structure on the distal end of the ureter Reliquet ascribed the right hydro-ureter and hydronephrosis.

As in the female a persistent Wolffian duct may be presumed to be an accessory ureter, so in the male may a persistent Müllerian duct be so described. This is illustrated in the case reported by Woolley and Brown.⁵⁴ The individual in whom the peculiarity was accidentally found during post-mortem examination was an adult male (age not stated) who had died from blastomycosis. During life there had been no urinary symptoms. Each kidney weighed 200 grm., the capsule was adherent and the blood vessels somewhat sclerotic. There was medullary hyperplasia of the left suprarenal gland and the right suprarenal gland was absent. Extending from the antero-lateral aspect of the right kidney, *i.e.*, from the normal site of the right suprarenal

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gland, there appeared a distended, tortuous, sacculated tube which ran parallel with the right ureter and finally passed to the posterior surface of the prostate. Its average diameter was 20 mm., its widest part, 45 mm. At its distal end it became rapidly constricted almost to occlusion. Through the lower end a fine probe could be passed into the prostatic urethra through the colliculus seminalis. The proximal end of the tube passed into a mass of tissue measuring $20 \times 10 \times 10$ mm., supposed to be the remains of an atrophic suprarenal gland. There was no connection between the tube and the kidney, ureter, or bladder. Both testes were normal. Microscopic examination of the mass at the proximal end of the tube showed fibrous tissue with cystic spaces, blood vessels, nerves, and columnar or cubical cells which seemed to represent ducts in section. The larger cysts were lined with cubical epithelium and contained some epithelium which had undergone degeneration. The smaller cysts were lined with columnar or cubical epithelium and contained a colloid material in some places simulating the corpora amylacea of the prostate. The structure showed an occasional resemblance to a Wolffian body. The tube itself had fibrous walls containing a little plain muscle fibres and it was lined with low columnar or cuboidal cells.

In this case doubtless the absence of the right suprarenal gland had favoured the retention of the Müllerian duct and at its cephaled extremity a more or less altered portion of the mesonephros.

Finally the post-mortem examination is reported by Verliac⁵¹ of a man, aged 80, who died of carcinoma of the prostate. The kidneys were of equal size and each had two "ureters." Those on the right side passed from the kidney to the bladder into which they opened 10 mm. apart. On the left side the inferior ureter was the continuation of a dilated renal pelvis, it was regularly thickened and dilated and opened normally into the bladder. The superior "ureter" arose from the tissue immediately superior to the kidney as a broad thin-walled canal forming a cavity whose walls were entirely fibrous with clear urine-like fluid contents. At 30 mm. from this origin the tube narrowed where it was crossed by a blood vessel and there formed a fusiform dilatation until it met an artery from the inferior extremity of the kidney. Caudad to this it formed an irregular canal with thin walls as far as the left lobe of the prostate into which it penetrated in front of the

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left seminal vesicle. It pierced the prostate as a thin duct and opened into the prostatic utricle.

In Verliac's case as in so many cases of reported accessory ureters a duct originates cephalad to a normal kidney, passes caudally in close relation with a practically normal ureter and keeping clear of the bladder opens into the male uterus. It must be confessed that such an occurrence associated in a male subject with a normal testis and cord bears the ineffaceable evidence of a persistent Müllerian duct which no distorsion of reasoning can prove to be ureteric. That it is associated with some abnormality of the suprarenal, the kidney, the bladder, or with some congenital defect not in its immediate neighbourhood only lends probability to an early embryonic disturbance in which the Müllerian duct in the male or the Wolffian duct in the female may well participate.

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THE VALUE OF ILEO-COLOSTOMY IN ACUTE INTESTINAL OBSTRUCTION.

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It is now generally accepted that deaths in ileus are due to absorption of toxins elaborated in the upper jejunum. Any operation for the relief of intestinal obstruction must therefore make provision for jejunal drainage.

In the short-circuiting operation of ileo-colostomy the jejunal contents are drained into the large intestine, where they are no longer toxic on absorption. With this provision for reabsorption there is no loss of body fluids, and here we find a distinct advantage over the operation of jejunostomy—a form of external drainage. Moreover, as will be shown later, ileo-colostomy affords continuous relief to the accumulation of intestinal contents above the site of the obstruction, and provides the earliest workable alimentary canal with which to nourish the patient.

The table on pp. 728, 729 includes all the cases of acute intestinal obstruction under my care during the past year. One may appreciate how often the short-circuiting operation appears suitable.

Summary of Cases.

| | Cases. |
|---|----------|
| Large Gut Obstruction | 7 |
| Intussusceptions | 2 |
| Tuberculous Lesions | 3 |
| Volvulus of Small Intestine | 2 |
| Strangulated Hernia, Inguinal | 4 |
| " " Femoral | 3 |
| Internal Hernia | 1 |
| Obstructed Umbilical Hernia | 1 |
| Bands and Non-tuberculous Adhesions | 5 |
| Tumour Ileo-cæcal Valve | 1 |
| | <hr/> 29 |

Mortality, 3.0 = 10½ per cent.

The following are the detailed histories of ten of the above cases where an anastomosis was performed:—

CASE I.—No. 3, Reg. No. 4414/25. Mary O'C., aged 25, was admitted to hospital on 16.9.25, with a history of abdominal pain and vomiting of eighteen hours' duration. During the month prior

CASES OF ACUTE INTESTINAL OBSTRUCTION, AUGUST 1925 TO 1926.

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| No. | Age. | Hospital No. | Diagnoses. | | | Operation. | Result. |
|-----|------|--------------------|--------------------------------------|----------------|-------|------------|-----------|
| | | | Acute obst. | S. gut. | T. B. | Peri- | |
| 1 | 44 | Pte. case, Miss C. | Acute obst. tonitis | | | | Relieved. |
| 2 | 6/12 | 4114/25, Robina C. | Intussusception | | | | Cured. |
| 3 | 25 | 4414/25, Mary O'C. | Acute obst. Perit. band | Small gut. | T. B. | | Recovery. |
| 4 | 47 | 4425/25, Wm. F. | Perisigmoiditis. ileum with volvulus | Adherent loop | | | Relieved. |
| 5 | 63 | 4919/25, Robt. M. | Ileo-cæcal valve. acute obstruction | Tumour causing | | | Recovery. |
| 6 | 71 | 5319/25, Mrs C. C. | Carcinoma, sigmoid | | | | Died. |
| 7 | 72. | 5655/25, Alex. W. | Carcinoma, sigmoid | | | | Relieved. |
| 8 | 57 | 5707/25, Jas S. | Strang. L. ing. hernia | | | | Recovery. |
| 9 | 74 | 6010/25, Mrs A. H. | Strang. R. fem. hernia | | | | Died. |
| 10 | 47 | 6204/25, D. M. | Internal hernia | | | | Recovery. |
| 11 | 6/12 | 1025/26, Sarah H. | Intussusception | | | | Recovery. |
| 12 | 16 | 90/26, H. C. | Volvulus of ileum | | | | Recovery. |
| 13 | 61 | 184/26, J. C. | Obst. band of twisted omentum. | | | | Recovery. |
| 14 | 16 | 868/26, J. S. | Acute obstruction. ing a band | Appendix form- | | | Recovery. |

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Ileo-Colostomy in Intestinal Obstruction

| | | | | | |
|----|----|--------------------|---|---|-------------------------|
| 15 | 42 | 874/26, Mrs J. W. | Obst. umbilical hernia | Ileo-transverse colostomy. No drain | Relieved. |
| 16 | 16 | 1545/26, Nellie F. | Kinking of ileum due to T. B. Peritonitis | Ileo-colostomy. No drain. Died on 12th day from pneumonia | Died. |
| 17 | 78 | 1975/26, Mrs A. P. | Malignant tumour of sigmoid | Mikulicz's exteriorisation and immediate opening. Later tumour mass shaved off with diathermy knife | Relieved. |
| 18 | 32 | 1983/26, Brown | Kinking due to post-op. adhesions | Jejuno-colostomy (asc. colon) | Relieved. |
| 19 | 45 | 2137/26, Mrs M. L. | Strang. fem. hernia | Simple radical cure | Recovery. |
| 20 | 51 | 2282/26, Mrs A. M. | Strang. fem. hernia, R. | Resection ileum (30 inches). Side-to-side ileo-ileostomy | Recovery. |
| 21 | 32 | 2332/26, Mrs A. G. | Kinking due to post-op. adhesions | Ileo-colostomy. Drained. Cause of obst. irremovable | Recovery. |
| 22 | 33 | 2713/26, Geo. G. | Strang. R. ing. hernia | Ileo-colostomy and radical cure. Drained suprapubically | Relieved. |
| 23 | 26 | 2820/26, John N. | Post.-oper. adhesions | Jejuno-jejunostomy. No drain. | Relieved. |
| 24 | 66 | 3442/26, Jos. H. | Inoper. carc. sigmoid | Colostomy left inguinal | Relieved. |
| 25 | 86 | 3400/26, Geo. M. | Strang. R. ing. hernia | Local anaesthesia. Radical cure | Recovery. |
| 26 | 41 | 4337/26, Mrs A. G. | Carcinoma transverse colon | (1) Caecostomy. (2) Excision of transverse colon. (3) Removal of caecostomy tube | Recovery. |
| 27 | 55 | 4808/26, Mrs M. P. | Tumour pelvic colon | Caecostomy. Tumour inoperable | Relieved and to return. |
| 28 | 73 | 4966/26, Peter B. | Strang. L. inguinal hernia | Radical cure under local infiltration anaesthesia | Recovery. |
| 29 | 60 | 4967/26, M. S.—n. | Tumour trans. colon. Epithelioma omentum | Caecostomy | Relieved. |

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to admission she had frequent attacks of upper abdominal pain which came on immediately after food and lasted from ten to thirty minutes. These attacks were not accompanied by vomiting but there was a great amount of flatulence. The bowels would only move with purgatives. She had a miscarriage three months before. When the present attack commenced the patient was awakened at 2 A.M. The pain was very severe and of a colicky type situated at the umbilicus. The pain continued all day and she vomited repeatedly. The temperature was 98.4° F., pulse 98, and leucocytes 12,000.

There was general fullness of the abdomen, and muscular resistance in the right iliac fossa, where there was a slight degree of tenderness. She vomited any water she drank, and she looked very ill. Her general condition was poor. The sp. gr. of the urine was 1036. Under chloroform and ether anæsthesia a mid-line incision was made some 4 inches in length and mainly infra-umbilical. An adhesive band was causing obstruction of the lower ileum. There was marked distension of the ileum, 2 feet of which looked very unhealthy and showed numerous hæmorrhages and a lack of lustre. The mesentery was very thick and contained numerous tuberculous glands. There was a bilateral pyosalpynx. About 8 feet of bowel was resected and a side-to-side ileo-ascending colostomy performed. A glove drain was inserted into the pelvis.

On the following day, while the pulse was rapid, the general condition was distinctly better and the bowels moved four times. She continued to have bi-daily bowel movements until the tenth day, when the stitches were taken out and the wound was dry and healed. After this the bowels only moved once per diem. She was transferred to the convalescent home where she rapidly put on 20 lb. in weight, and looked very well indeed.

Commentary.—This patient looked so ill that I doubted whether she would stand resection. One might argue that local anæsthesia would have diminished the shock of the operation. But with the small amount of chloroform and ether that these toxic cases require there is much less risk of the distended gut escaping than with local anæsthesia, and everyone knows how much valuable time is lost in trying to get the bowel back into the abdomen. Further, I consider that the escape of bowel is a technical tragedy which increases shock enormously, and greatly adds to the risk of paralytic ileus by dragging on the mesentery and also by depriving the already-stretched bowel-wall of any external support.

In some of my earlier cases I infiltrated the abdominal wall

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with novocain, opened the peritoneal cavity, and conducted the inspection thereof under general ethyl chloride anæsthesia. I gave this method up as I could not handle the mesentery for any length of time, and when this was inflamed it precluded intra-mesenteric injection of novocain. I think that the mesentery, in cases of acute obstruction, no matter how short the duration thereof, should not be infiltrated, as it adds to the paresis of the gut, and further there is always a degree of incipient inflammation present which ought to contra-indicate novocain injection owing to the fillip it gives to infection.

In the case at present under discussion, I considered that jejunostomy would never have removed the contents from the paralytic and kinked loops of the ileum. The ileum was therefore resected, but the operation was rendered difficult by the large tuberculous glands in the mesentery, and consequently the number of feet of bowel removed was determined by section of the mesentery where it seemed to be safe and unlikely to make hæmostasis difficult.

It will be noted that the bowels moved four times within twenty-four hours. The high specific gravity of the urine is also noteworthy. I find that, if the morning urine be disregarded (as it is normally of high sp. gr.), the urine readings in cases of acute obstruction show a variation between 1035 and 1045. I regret I omitted to record the results of abdominal auscultation in this case.

CASE II.—No. 5, Reg. No. 4919/25. Robt. M., aged 63, was admitted to hospital on 16.10.25, complaining that he had been unable to pass wind or get the bowels opened during the previous five days. For a year prior to admission he had been troubled with griping pains running from right to left across the lower abdomen. He felt as if he wanted to pass wind but it would only come so far and then stop. The present attack began after the bowels had moved. The pain was situated in the right iliac fossa and was of a severe colicky nature. He vomited for three days and on admission the vomit was stercoraceous. The temperature was 98.6° F., the pulse 88, and respiration 24. The patient looked very emaciated, the abdomen was very distended and tense. No ladder pattern was visible nor was any peristaltic movement audible on abdominal auscultation. On percussion the note was tympanitic all over, liver dullness being overlapped by the distended transverse colon. The tenseness of the abdominal wall made palpation difficult. On rectal examination a mass was felt high up on the right side. The prostate was small. The pulse, while of moderate quality,

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was regular. He was very thirsty and the mouth and tongue were very dry. He was micturating as often as he could to give him more room in the abdomen, as he thought.

Under chloroform and ether anæsthesia the abdomen was opened through a right paramedian incision. The fluid in the abdomen was allowed to escape. The small bowel, while markedly distended, did not show the thinning that is usually noticed in the wall. There appeared to be a compensatory hypertrophy similar to what is sometimes seen in the chronic forms of tuberculous obstruction. The cœcum was very distended with gas but I could feel a hard mass at the ileo-cœcal valve. The lower ileum was resected along with the proximal colon, and a side-to-side anastomosis made between ileum and transverse colon. The wound was drained. He was drowsy at times during his stay in hospital, but he was discharged on the 13.11.25.

I heard from his doctor about two months later that he had put on weight and was feeling better than he had done for a year or two. When the patient reported at hospital, nine months after operation, I did not see him but learned that he was 2 stones heavier and looked very fit. His own doctor confirmed this.

The specimen was sent to Professor L. R. Sutherland of the Pathological Laboratory University College, Dundee. I am indebted to Professor Sutherland for the following report: "Ileo-cœcal cancer with complete obstruction of the valve. There is a pathological fistula between the last piece of the ileum and the cœcum due to the tumour eating through the cœcum into the ileum. This fistula is obstructed by a knot of coarse string, and the impaction of this knot of string has caused the acute attack of obstruction."

Commentary.—As this patient's condition was so poor and his tissues were so dehydrated, I felt that I was bound to lose him if I attempted a resection. But I considered that if I had done an ileostomy he would have lost so much more body fluid that he would have certainly died. The case was essentially one of small gut obstruction. The terminal portion of the ileum was so paralysed that it demanded resection. The vessels were visible as there was no intra-peritoneal fat, and I decided to give the patient the chance of the operation which I judged was the correct one for the mechanical lesion. The actual resection was very easy and did not take ten minutes longer than a simple short circuit would have taken.

CASE III.—No. 8, Reg. No. 5707/25, was that of a man aged 57, who was admitted to hospital on 1.12.25. For the previous seven years he had a left inguinal hernia but he could always reduce it when he



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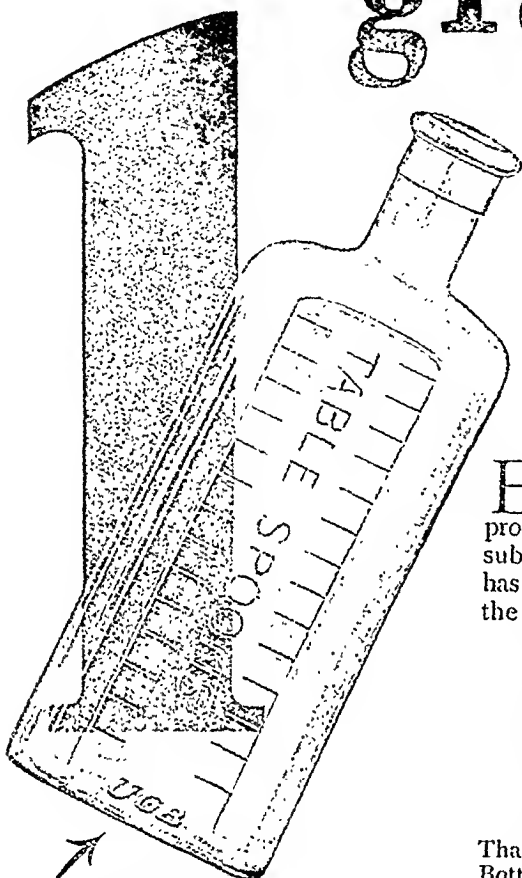
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assumed a recumbent position. On the 30.11.25, while mounting his cart, his scrotum struck a projecting post causing him to faint. He could not reduce the rupture but he was able to pass flatus. On the following day the scrotum was very much swollen and he had severe pain in the lower abdomen. He was vomiting steadily and could not pass flatus. On admission his temperature was 97.5° F., his pulse rate 88, and respirations 20 per minute. He was very muscular, and on palpation there was marked resistance in the lower abdomen. The scrotum was as big as a melon and hard and inflamed.

The sac of the hernia was exposed under chloroform and ether anaesthesia. It was found to contain 3 feet of foul-smelling and deeply injected small intestine. Approximately 5 feet of bowel was resected and a side-to-side ileo-ileostomy performed. A drain was placed in the scrotum.

Commentary.—Evidently the trauma sustained when he mounted his cart caused a hæmorrhagic effusion into the mesentery of the bowel in the sac of the hernia. The resulting swelling had interfered with the vascular supply of the gut and thrombosis had resulted. Resection of the damaged loop was therefore indicated and a ileo-ileostomy was performed as the colon could not be dragged over to the left internal abdominal ring. There was considerable trouble with hiccough during the first few days after operation which was not controlled by stomach lavage. He was also slightly distended from time to time. The recovery here was not so uneventful as in the ileo-colostomy cases. His lengthy stay in hospital was due to a septic hæmatoma of the scrotum after the drain had been removed. The drain was not inserted through the lowest part of the scrotum. I have, unfortunately, no note of the dates of his bowel movements.

CASE IV.—No. 15, Reg. No. 874/26. Mrs J. W., aged 42, admitted 10.2.26, discharged 4.3.26.

Complaint.—Abdominal pain and vomiting of two days' duration.

History.—The patient had been operated on for umbilical hernia in 1919, but the hernia, recurring after the birth of a child, gradually increased in size. During the past three or four months she had had attacks of griping pains in the abdomen accompanied by sickness and vomiting. During the two days prior to admission she had very severe colicky pains and she vomited steadily. Her stomach also rejected sips of cold water. On examination the temperature was 99° F., the pulse 100, and respirations 20. The patient was extremely stout. There was a huge umbilical hernia measuring about 4 feet across. On

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abdominal auscultation it was easy to time the onset and termination of each colicky spasm. The sp. gr. of the urine was 1038.

Under chloroform and ether anaesthesia a transverse incision was made in the upper epigastrium. There was a large amount of free fluid in the abdomen. An anastomosis was made between the lowest available loop of jejunum and the transverse colon. The gut in the various loculi of the hernia was then freed and repaired. No drain was inserted. On the 11.2.26 she was very well and all sickness had ceased. On the 12.2.26 the bowels moved twice, but there was a little distension in the hernia. The next day the bowels again moved twice but all trace of distension had disappeared. On the 20.2.26 her stitches were taken out and X-rays showed that the short-circuited ileum was not functioning, but a week later both the anastomotic opening and the ileum were working.

Commentary.—The hernia was so big that it would have been dangerous to deal directly with it; and one had no idea in which loculus the gut was obstructed. The difficulty of getting into the abdomen was apparent, and thus a transverse incision was made in the upper epigastrium, through which, I considered, I would be able to anastomose a loop of jejunum to a portion of large gut proximal to the splenic flexure. The depth (from the skin surface) at which the anastomosis had to be performed, necessitated the introducing of the intestinal clamps into the abdominal cavity prior to clamping the bowel. The jejunum emptied so well that I felt that I could safely seek the obstructed loop. This was carried out and the contents emptied into the lower ileum. It is doubtful whether the ileum would have functioned with simple freeing of the obstructed loop. The anastomosis will always act in the event of obstruction threatening to recur.

CASE V.—No. 16, Reg. No. 1545/26, was that of a girl of 16 years who was admitted to hospital on the 13.3.26. She gave the history of having suffered from severe colicky pains for forty-eight hours. Vomiting commenced after the onset of the pain, and there had been no bowel movement or passage of flatus. The vomit was frequent and had become brown in colour. The abdomen was distended, and there was an area of greater resistance in the right iliac region. Definite tenderness was elicited over McBurney's point, and there was also bulging and tenderness high up in the right rectal wall. Abdominal silence was noted on abdominal auscultation. The leucocytes were 15,000 cms. A specimen of urine was not available prior to operation.

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The abdomen was opened through a gridiron incision and a considerable amount of obstructive fluid escaped. There was a marked plastic tuberculous peritonitis present with numerous large tuberculous glands in the enteric mesentery. The adhesions had caused a complete twist of a knuckle of bowel. This was undone but the wall was unhealthy looking and showed numerous hæmorrhages. As this portion of gut was unlikely to recover its function for a considerable period of time, and as the more proximal gut was very much distended, an ileo-ascending colostomy was performed. The abdomen was not drained. The stomach was washed out several times after operation. The bowels moved in thirty-six hours, and then three times a day until the twelfth day when death took place from broncho-pneumonia. There was no autopsy.

Commentary.—This was a very disappointing result, when the patient had so completely recovered from the effects of the obstructive attack. Although she had been very bright and said she was feeling very well her chest had never completely cleared after the anæsthetic. As her wound was septic, and as the site of a subcutaneous saline injection had also become septic, I considered that the anærobic infection was at least a secondary cause of death. The obstruction had, by the time of operation, reached the peritonitic stage, and I think it would have been better judgment to have drained the wound. The numerous glands in the mesentery would have made resection a very difficult and lengthy operation. I do not care to interfere with a tuberculous area in the presence of an infective process.

CASE VI.—No. 18, Reg. No. 1983/26. D. B., a man of 32 years, who was admitted to hospital on 3.4.26 with a history suggesting duodenal ulcer. He was operated on by my chief, Mr John Anderson, who found that almost the whole of the small intestine was contained in a large paraduodenal hernia. The internal hernia was reduced, the sac averted and the neck tied. The sac was then removed. There was a large duodenal ulcer present and also an unhealthy appendix. A posterior gastro-jejunostomy with appendicectomy was performed. Thirteen days later, on the 19.4.26, I was asked to go and see the patient as he had been vomiting incessantly for 15 hours, and was obviously suffering from an acute obstruction high up in the jejunum. I opened the abdomen through the original right rectus incision and found that the abdominal wall was in much the same condition as one meets with in a wound which ruptures about five days after operation. A loop of jejunum was adherent to the deep surface of the wound and it was fully 2 inches in diameter. Immediately below this bowel was

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acutely kinked by an inflammatory adhesion. The small intestine was red and "angry" looking. A portion of jejunum, about 3 feet distal to the flexure, was anastomosed to the ascending colon and the jejunal contents emptied therein. The wound was drained. He made an uninterrupted recovery and left the hospital three weeks later. He has been seen on several occasions and is not losing weight, nor is he troubled with too frequent bowel movements. X-ray examination has shown that the small intestine is functioning.

Commentary.—The presence of the inflammatory process favoured the re-formation of adhesion. A jejunostomy would have rapidly produced dehydration and inanition. Further, there would have been the risk of digestion of the wound ensuing. I consider that this case is the type where jejuno-colostomy is indicated par excellence.

CASE VII.—No. 20, Reg. No. 2282/26. Mrs A. M., a woman of 51 years, was admitted to hospital on the 14.4.26 suffering from a strangulated right femoral hernia. When she was lifting a basket of clothes, some thirty-six hours prior to admission, she felt her rupture "give." She then became very sick and vomited about twelve times. The vomit was of a greenish or bilious colour at first, and, later, became brownish. Flatus had not been passed since the onset. There was an irreducible and tender swelling, the size of a hen's egg, in the right groin. The lower abdomen was distended and resistant. Abdominal auscultation was untrustworthy, as $\frac{1}{3}$ grain of morphia had been given prior to admission.

Under chloroform and ether anæsthesia a T-shaped incision was made over the swelling. The sac was freed in the groin and the neck exposed and opened above Poupart's ligament. The strangulated knuckle of bowel was so devitalised that some 30 inches of bowel had to be resected. A side-to-side ileo-ileostomy was performed. The sac was plicated and interposed between Poupart's and Cooper's ligaments. The wound was drained and the stomach washed out.

Commentary.—It would not have been an easy matter to have performed an ileo-colostomy, and the incision would have had to be enlarged in order to bring the ascending colon to the surface. This would have entailed division of the deep epigastric artery and section of an already weakened abdominal wall. The bowels moved on the 5th day and then twice daily until she left hospital on the 17th day. The pulse was never above 88 per minute, and the highest recorded temperature was 98.2° F. X-ray examination just before she was discharged

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Ileo-Colostomy in Intestinal Obstruction

showed that the passage of the intestinal contents was slightly faster than normal. This case showed no post-operative vomiting or distension, but it will be noted that the bowels did not move until the 5th day,—a delay which would give fatal results in more severe cases.

CASE VIII.—No. 21, Reg. No. 2352/26. Mrs A. G., a woman of 32 years, was admitted to hospital on 18.4.26 with severe abdominal pain of four hours' duration. The pains had increased in severity and were of a gripping character. She vomited her food after the onset, and, later, a brownish fluid. In 1921 she was operated on for volvulus of the small intestine. Prior to this she had an operation for adhesions of probably appendicular origin. On inspection, no peristaltic movements were seen, felt, or heard. There was a distinct fullness in the lower half of the abdomen and there was dullness in the flanks.

Under general anæsthesia the abdomen was opened through an exploratory right rectus incision. There was obstructive fluid in the abdomen, and the greater part of the small intestine was in a tangle of adhesions which it would have been impossible to separate. The jejunum was distended. A jejuno-ascending colostomy was performed and the wound drained. On the following day she required a further stomach wash but the bowels had moved by the next day and there was no further vomiting. The wound was healed on the twelfth day and she was discharged after twenty days' residence. X-ray examination showed that both anastomosis and the ileum were functioning. She came up to see me about a month later complaining of a fullness in the abdomen. This was quickly relieved by placing her on a couch, the foot of which was elevated. She has had no similar and further attacks.

Commentary.—This case illustrates that, in the presence of adhesions, a loop of gut in becoming distended tends to kink and ultimately to form a complete obstruction. Although the mass of adherent bowel was a constant source of danger, resection would have been a dangerous undertaking as one could not see the mesentery, and the posterior parietal wall seemed to be involved. A jejunostomy, while it would have relieved the condition, would only have done so temporarily, and provision had therefore to be made in the advent of another obstructive attack occurring. A jejuno-colostomy was performed, as it not only drained the distended jejunum but also made this permanent provision against future obstructive attacks.

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CASE IX.—No. 22, Reg. No. 2713/26. Geo. G. was admitted to hospital on the 6th May 1926, with a history that, some eight hours previously, something had given way in his rupture while he was at work on his farm. He experienced severe abdominal pain and commenced to vomit. He found that the rupture had considerably increased in size. On examination the right side of the scrotum was very much swollen and a right inguinal hernia was strangulated. The contents of the sac included bowel. Taxis had been attempted by his doctor and by two others.

Under chloroform and ether anæsthesia the sac was opened. The strangulated loop of small intestine was dark in colour and showed large intramural hæmorrhages. There were also hæmorrhagic patches in the mesentery. An ileo-ascending colostomy was performed; the neck of the sac was divided and sutured; the inguinal canal was repaired; and a glove drain was inserted supra-pubically into the recto-vesical pouch.

Commentary.—Although there was no loss of lustre, a short-circuiting operation was performed, as there were numerous hæmorrhages into the wall of the bowel and into the mesentery. This always produces a condition of temporary paresis. The cœcum and ascending colon were so mobile that an ileo-colostomy was easily performed.

CASE X.—No. 23, Reg. No. 2820/26. J. N., aged 26, was admitted to hospital on 10.5.26. He had had a gastro-jejunosomy and appendicectomy in November 1925, but after a few weeks, pain and vomiting commenced to occur immediately after food, and this state of discomfort continued off and on until 9.5.26, when the pain became very acute and vomiting continuous.

On examination the tongue was very dry and furred. There was tenderness and slight muscular resistance in the epigastrium.

Under chloroform and ether anæsthesia the abdomen was opened by a mid-line incision above the umbilicus. A loop of jejunum presented a "double-barreled" appearance, due to the two limbs of the loop being firmly adherent together. This resulted in acute kinking which was the cause of the obstruction. There was no jejunal ulcer present. The adhesion between the two portions of jejunum was separated but the resulting raw areas were too extensive to be covered by peritoneum. An anastomosis was therefore made between the two limbs of the loop where they had been adherent, *i.e.*, at the raw area. On the day following this operation the patient vomited considerably and required gastric lavage. He had a few sick turns until the fifth day, after which his recovery was uninterrupted, and he has remained well.

Ileo-Colostomy in Intestinal Obstruction

Commentary.—The raw areas could not be peritonised even by utilising one of the layers of the mesentery, and, as adhesions would have re-formed, the choice of operation was resection or short-circuit. I chose the latter, as the patient was not in a good condition and resection would have taken longer.

Discussion.

Comparison of Ileo-ileostomy and Ileo-colostomy at Operation.—It will be seen from these ten case-histories and commentaries that there are five cases of simple ileo- or jejuno-colostomies; two resections with ileo-colostomy; one case of simple jejuno-jejunostomy, and two resections with ileo-ileostomies. In these types of operation, there is no difference in the main principle, for, in all, the contents of the gut proximal to the obstruction are drained into the healthy gut beyond.

I prefer to drain into the large intestine. Whenever the anastomotic clamps are removed the small gut empties into the colon so much more effectively than when the anastomosis is made with the lower ileum. Moreover, the ileo-cæcal valve prevents, in ileo-colostomy, the toxic obstructive fluid regurgitating towards the obstructive site. This regurgitation or "flow-back" is seen at operation to take place in ileo-ileostomy, and it causes stagnation of fluid in the short-circuited loop. The sooner the toxic fluid is removed from the gut immediately proximal to the obstruction (*i.e.* the dangerous area), the sooner will the toxæmia diminish. A third and important point arises owing to the pelvic position of the terminal ileum and its liability to ileus whenever peritonitis is present. More especially is ileus likely to occur in the consecutive peritonitis of acute intestinal obstruction. One has frequently observed, in bad cases of appendicitis, that whenever a slight degree of ileus is present there is a coexisting gaseous distension of the ascending colon and cæcum. Under those conditions the weakened peristaltic movements of the ileum have not the "push" necessary to overcome the "large gut pressure-apposition" of the two folds of the ileo-cæcal valve. Consequently the lower ileum becomes increasingly distended and peristalsis is thus further weakened until ileus is fatal. The following case will illustrate these points:—

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CASE XI.—Reg. No. 1340/24. Wm. H., aged 44, was admitted to hospital with the complaint of discomfort in the abdomen “as if there were something to be passed on which would not.” This condition became worse and he had been vomiting steadily for thirty-six hours prior to admission. No flatus had been passed for three days. Temperature 96° F., pulse 132 per minute. On physical examination there was cyanosis of the face, lips, ears and extremities. His face was very pinched, but he talked readily, and frequently raised himself up to vomit a dark brown and foul-smelling fluid. The abdomen was very distended and prevented deep palpation. The pulse was irregular and of poor quality. Under local infiltration anæsthesia the abdomen was opened through a right gridiron incision. On opening the peritoneal cavity, the cœcum, which was very distended, herniated through the wound. There was much obstructive fluid in the peritoneal cavity. The terminal ileum was collapsed and empty. Some 4 feet above the ileo-cœcal valve was a loop of darkly-coloured and distended ileum. This was found to be an internal hernia strangulated beneath a Meckel’s diverticulum, the apex of which was adherent to the under side of the mesentery. The hernia was reduced and the contents of the loop were seen to pass on into the terminal ileum. The wound was closed and the stomach washed out. He was given radiant heat, stomach washes, subcutaneous salines, flatus enemas, colon siphonage, etc., etc., but he died two days later. I reopened the wound immediately after death as an autopsy was not granted. The cœcum was more distended but with gas only, and the terminal ileum was filled with fluid. Obviously the ileum had not the power of contraction necessary to open the ileo-cœcal valve against the increased pressure in the cœcum and ascending colon. Nor had the valve opened after the gaseous pressure in the colon had been negated by the passage of a flatus tube into the upper colon. Evidently the ileus had become absolute.

Further, where ileus is probable in bad cases of appendicitis, some surgeons perform cœcostomy, and by so doing negate any pressure in the ascending colon. It is then easier for the lower ileum to pass its contents onwards. But, while cœcostomy undoubtedly saves many cases from developing ileus, the principle of emptying an obstructed loop makes me push the cœcostomy tube through the ileo-cœcal valve into the ileum. I am thus able to siphon off the contents of the ileum and reduce the toxæmia. When the ileum is able to empty, as evidenced by satisfactory drainage through the tube, the apex of the latter is pulled back into the cœcum. Here again the success attained by immediate drainage of the affected loop

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in peritonitic ileus makes one averse to ileo-ileostomy where the "regurgitation of toxic contents" delays the drainage of the affected or dangerous loop.

The Effect of the Ileo-cæcal Valve on Ileus.—I perform an ileo-colostomy in preference to ileo-ileostomy and thus provide a temporary alimentary canal in which there is no ileo-cæcal valve. In other words I aim at "cutting out" the action of the valve, and this is what happens also when I treat early ileus by pushing a cœcostomy tube through the ileo-cæcal valve. The present-day knowledge of the action and innervation of the ileo-cæcal valve is far from being complete, but I would venture to submit two clinical observations which appear to depend on the presence of the valve.

1. If ileus is likely to occur, but has not actually commenced, a simple cœcostomy can avert its onset.

2. Simple cœcostomy rarely, if ever, stays the progress of an ileus already established.

I think the former observation can be explained by the cœcostomy preventing any gaseous pressure arising in the colon, and thus removing any impediment to the opening of the valve. If ileus has not actually commenced the ileum is capable of dealing with the gaseous or fluid content under pressure since the tonicity of the muscular coat is still present.

Other factors have to be considered when a condition of ileus is definitely established. The small gut is distended, and there is increased intra-abdominal pressure. The wall of the ileum is inert and cannot resist further distension by the increasing amount of gaseous and fluid content. If the abdomen be opened at this stage and a simple cœcostomy performed any increased pressure in the proximal colon will certainly disappear, but the intra-abdominal pressure will now become that of the atmosphere. Thus one would have an inert and fluid-containing ileum separated from the colon by a valve with all increased pressure factors absent.

Another method sometimes adopted in place of a cœcostomy is the passage, per rectum, of a flatus or stomach tube right up into the cæcum. The colon pressure can thus be negatived, but as the ileum is inert the pressure now exerted on both sides of the valve will be that of the intra-abdominal pressure, so that no help to the emptying of the ileum is given by this procedure.

Some claim to be able to pass a stomach tube per rectum up into the colon and through the ileo-cæcal valve into the ileum.

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If this be possible then the ileum could be siphoned and ileus thus treated. But I sometimes find it not altogether easy to pass a cœcostomy tube directly through the valve, and surely it would be much more difficult to get the flatus tube through the valve when one has no control over the apex of the tube. The position of the tube would require proof by direct observation or by X-ray.

One has therefore to deal directly with the ileum and drain it, as any interference or operative procedure distal to the ileo-cæcal valve will fail to benefit a paralytic condition on the proximal side. The methods that are thus left at our disposal are ileostomy and ileo-colostomy.

Operative and Clinical Considerations.—Having discussed some mechanical observations, it will be seen that the deductions made therefrom are supported by post-operative and clinical considerations. Clinically, the ileo-colostomy cases improve much more rapidly than those where ileo-ileostomy has been performed. In the former the abdomen becomes progressively flat, and the "bowels move" naturally within thirty hours after operation. One stomach wash is generally all that is necessary. In ileo-ileostomy, on the other hand, the patient does not recover from the toxæmia so quickly; there is often post-operative distension; stomach washes have to be repeated, and bowel movement is delayed and is often worrying. I reserve the operation of ileo-ileostomy for tiding the patient over a temporary paresis of the more proximal ileum as, for instance, in cases of strangulated hernia.

In choosing a site at which to perform the anastomosis it must be remembered that the portion of gut proximal to the obstruction (*i.e.* the dangerous area or loop), has to empty back through the anastomosis. The anastomosis should therefore be made with healthy gut as close to the obstruction site as possible. It is wise to "milk" the contents of this loop through the anastomotic opening into the large intestine. This procedure removes the toxic fluid from the dangerous area.

If the condition of the patient is grave the abdomen can be opened with local infiltration anæsthesia. The omentum will present and, if incised in a vertical direction, can be readily stripped off the transverse colon for a distance of 4 inches. A distended loop of ileum or jejunum will then herniate through the opening in the omentum, and an anastomosis can be easily effected with the transverse colon.

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The omentum is then stitched over the line of the anastomosis. Care must be taken not to stitch too tightly as the fine intestinal suture will cut through or tear the thinned jejunal wall. A Dulox or Souttar needle is a necessity.

In resection cases the dangerous area is excised and any obstruction fluid in the more proximal gut is immediately drained into the large intestine where it ceases to be toxic and is available for absorption. I am of the opinion, where the obstruction is at the jejuno-ileal junction, that it is safer to resect the whole of the ileum along with the dangerous area than to perform a smaller resection with a jejuno-ileal anastomosis. Resection of the whole of the ileum is accompanied by less shock than one would expect. The following case will illustrate this assertion.

CASE XII.—Reg. No. 3481/26. George S., aged 34, was admitted to hospital three hours after a heavily-laden wagon had passed over his upper abdomen. He was suffering from a marked degree of shock and, obviously, internal hæmorrhage. There was no abdominal excursion, and tenderness was very pronounced all over the abdomen but more especially 2 inches below the left costal margin. There was bulging in the rectum; anæsthesia was induced with chloroform and continued with ether.

I opened the abdomen through an upper mid-line incision. The peritoneal cavity was full of blood, and mesenteric arteries were bleeding but scarcely spouting. The small bowel was cleanly stripped from the mesentery in three places—in two places for a distance of 3 feet and in a third place for a distance of 18 inches. There were also vertical tears in the mesentery. More than half of the small intestine was excised and a side-to-side jejuno-colostomy (ascending colon) was performed. A suprapubic glove drain was inserted and the abdomen was closed. The pulse began to improve in quality on his return to the ward. He was then given 10 ounces of 20 per cent. glucose per rectum. Two hours later his pulse was of good quality. He made an uninterrupted recovery and left the hospital on the fifteenth day.

I wish to emphasise in this case that, while the patient was already exhibiting a marked degree of shock, he was able to stand excision of the whole of the ileum.

Further, two of the four cases, where resection was performed, were in a much more critical pre-operative condition than the non-resection cases. Their clinical conditions were due to severe toxæmia. The dangerous toxic area in each was resected—a procedure which gives the most striking results.

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If there is a segment of small gut which appears to be severely paralysed resection is indicated, otherwise there will still be toxic absorption. The sudden and, as it were, almost complete relief from toxæmia after resection doubtless balances the shock of the operation, and consequently resection with ileo-colostomy should not be considered such a dangerous undertaking even in a severe case. It may be pointed out that resections are not true ileo-colostomies, but in both there is a "cutting-out" of the ileo-cæcal valve. This "cutting-out" of the valve is the feature of ileo-colostomy, as it permits of the toxic jejunal contents being rapidly drained into the large intestine.

Every case should be judged on its merits. If one considers that the obstructed loop if emptied will quickly regain its contractile power, then simple ileo-colostomy should be performed. In those cases the entire small intestine will ultimately re-function as evidenced by barium meals given during convalescence. And should the short-circuited loop attempt to obstruct once more there is always the safety valve—the anastomotic opening.

Various objections have been raised regarding the possible results—six or twelve months after operation. I have had, so far, no occasion to regret or undo any of my ileo-colostomies performed during the last three years. But the main point, one must remember, is that ileo-colostomy is essentially a life-saving operation. When the patient's condition is safe one can perform any secondary operation deemed necessary.

I will not comment on several unorthodox methods which I adopt as they are without the scope of this paper. I mention, however, four points :—

1. I always perform lateral anastomosis as any distension of the small intestine causes the anastomotic opening to gape and this automatically rectifies the condition.
2. The anastomosis is not made according to the "aseptic method," where it is open to argument how deeply the intestinal needle penetrates and whether the lumen of the bowel is unsuspectingly opened.
3. The methods of anæsthesia which I have to adopt are the best at my disposal.
4. The incisions are planned to give me direct access to the suspected site of obstruction. Preference is given to the muscle-splitting incisions as they are easier

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If there is a segment of small gut which appears to be severely paralysed resection is indicated, otherwise there will still be toxic absorption. The sudden and, as it were, almost complete relief from toxæmia after resection doubtless balances the shock of the operation, and consequently resection with ileo-colostomy should not be considered such a dangerous undertaking even in a severe case. It may be pointed out that resections are not true ileo-colostomies, but in both there is a "cutting-out" of the ileo-cæcal valve. This "cutting-out" of the valve is the feature of ileo-colostomy, as it permits of the toxic jejunal contents being rapidly drained into the large intestine.

Every case should be judged on its merits. If one considers that the obstructed loop if emptied will quickly regain its contractile power, then simple ileo-colostomy should be performed. In those cases the entire small intestine will ultimately re-function as evidenced by barium meals given during convalescence. And should the short-circuited loop attempt to obstruct once more there is always the safety valve—the anastomotic opening.

Various objections have been raised regarding the possible results—six or twelve months after operation. I have had, so far, no occasion to regret or undo any of my ileo-colostomies performed during the last three years. But the main point, one must remember, is that ileo-colostomy is essentially a life-saving operation. When the patient's condition is safe one can perform any secondary operation deemed necessary.

I will not comment on several unorthodox methods which I adopt as they are without the scope of this paper. I mention, however, four points:—

1. I always perform lateral anastomosis as any distension of the small intestine causes the anastomotic opening to gape and this automatically rectifies the condition.
2. The anastomosis is not made according to the "aseptic method," where it is open to argument how deeply the intestinal needle penetrates and whether the lumen of the bowel is unsuspectingly opened.
3. The methods of anæsthesia which I have to adopt are the best at my disposal.
4. The incisions are planned to give me direct access to the suspected site of obstruction. Preference is given to the muscle-splitting incisions as they are easier

Bronchitis Winter Cough

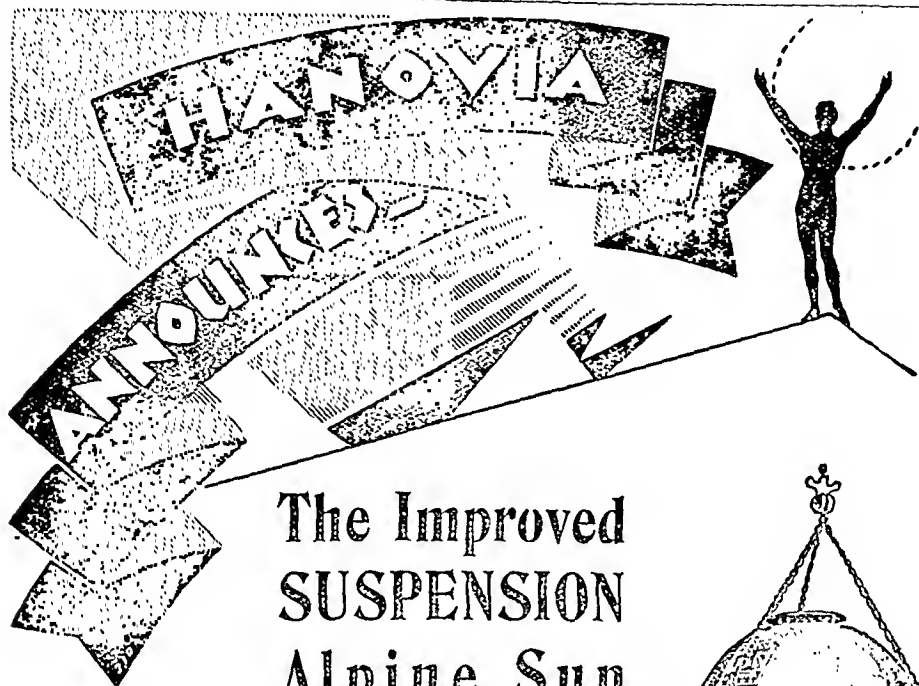
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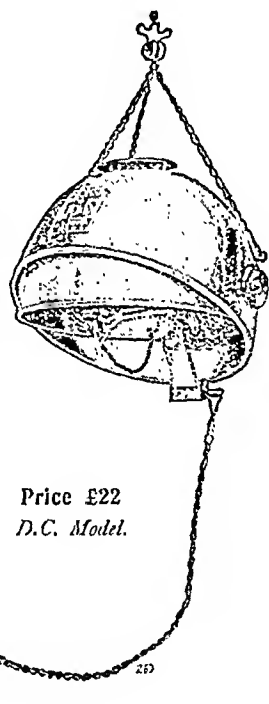
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Ileo-Colostomy in Intestinal Obstruction

to close and with them it is easier to prevent the distended bowel escaping outside the abdominal cavity. A gridiron incision can be extended up to the kidney region and down over the rectus sheath or the mid-line.

Summary.—It would appear that :—

- (1) Ileo- or jejuno-colostomy is indicated in acute intestinal obstruction to drain the proximal gut; to prevent ileus developing and in addition, where the cause of the obstruction is not removed, to provide a "safety valve."
- (2) The rapid recovery from toxæmia in ileo- or jejuno-colostomy cases suggests the importance of utilising the jejunal contents for absorption in a non-toxic state.
- (3) Ileo-ileostomy tends to produce a "vicious circle" and should be considered a preventive operation. It will not save a desperate case.
- (4) Resection with ileo-colostomy has been tried only in very toxic cases, and the initial success of this operation warrants a further and lengthy trial.

Since this paper was written Mr B. W. Williams has published his clinical research on "The Importance of Toxæmia due to Anærobic Organisms in Intestinal Obstruction and Peritonitis."*

He has evidence to show that the toxæmia, in cases of intestinal obstruction, results, in part at least, from the absorption of the toxin of *B. welchii* due to the proliferation of this anærobe in the stagnant contents of the small intestine. He considers that the acid reaction of the contents of the large intestine destroys *B. welchii* toxin.

One may assume from these deductions that the surgical treatment indicated is of the nature of immediate drainage of the toxic contents of the small intestine into the large intestine—*i.e.* ileo-colostomy. Further, since the conditions for the formation of the toxin are suitable in the lower ileum, drainage into the latter would appear to be inadvisable. Perhaps this explains why the ileo-colostomy cases in my series have given more satisfactory post-operative results than the ileo-ileostomies.

* *Ref. Brit. Jour. Surg.*, Vol. xiv., No. 54, pp. 295-322.

THE UNDERGRADUATE TRAINING IN MEDICINE.*

By Professor EDWIN BRAMWELL, M.D.

TO those of you who are about to be enrolled as graduates of our great University I would, in my capacity as promotor, wish God-speed. Wherever you go and whatever you do in your various callings we look to you to revere and reflect the glory of your School and do honour to her teaching.

Love of School, of University, and of Country are sentiments which are largely determined by tradition. An atmosphere is thereby created which influences the actions of the individual, the institution, and the race. When we recall those links with the past which constitute tradition, we assume indeed a force for good, whereby an emotional factor provides a stimulus which serves to translate our actions into terms of practical utility.

We trust that in the years to come you will ever remember the traditions of your Alma Mater and that in times of adversity such memories may afford you fresh hope, like the patch of blue in a dull and leaden sky, and encourage you to renewed endeavour.

But while tradition may thus serve as an inspiration and is consequently to be cultivated and fostered, we must see to it that we do not over-estimate the claims of "use and wont," for subservient obeisance to tradition may clog the wheels of progress. While jealously preserving the best features of the past, we must continue to exercise those capacities for adaptability and selective discrimination which have ever been such striking characteristics of our people.

I stand here, Graduands, as your sponsor. May all success attend you in your life's work.

The Undergraduate Course and the Training in Medicine.—You are for the most part entering the profession to which I have the honour to belong, and the majority of you will ultimately engage in general practice, a very honourable calling. The primary function of a great Undergraduate Medical School is indeed to produce the first-class practitioner. This with us is a tradition. Your Alma Mater, you must know, is just as

* The Promotor's Address, delivered at the Graduation Ceremonial, 14th July 1927.

The Undergraduate Training in Medicine

proud of the general reputation of her graduates as she is of the advances and discoveries effected by her most distinguished alumni.

The aim of our undergraduate course has been to train you as physicians. Our purpose has not been to train you to be physiologists or pathologists, still less to be chemists or zoologists. The same consideration applies in large measure to surgery, for there is a great deal of surgical practice you will never think of doing unless you have special training and indeed become specialists. Hence it is that we regard the training in medicine as basal and essential as no other training is.

I propose to devote this address to the training in medicine with special reference to certain dangers which, in my opinion, threaten its utility, and to their possible correction. There have been, it is almost unnecessary to remind you, great developments in the field of medicine in recent years, and it does not follow that methods which have been eminently successful in the past are necessarily adapted in every respect to meet the requirements of all time. Consequently it is advisable that those of us who are responsible for the undergraduate's training should pause occasionally to take stock of our position and attempt to visualise the future. The time is opportune, for the dislocation due to the war is over and the number of students has again fallen to the normal.

As the occupant of one of the chairs of medicine in the University, and as a practising physician who has devoted very considerable time and thought to the undergraduate training in medicine, I venture to think that in expressing my personal views I am in a position to do so with some authority.

The Basal Sciences and the Training in Medicine.—"Long experience shows that the future success of the physician is largely influenced by his preliminary training." So wrote a great physician. Our success as an Undergraduate School is without a doubt largely attributable to the realisation of this maxim.

Physiology is the essential basal science upon which medicine is founded. Hence the importance of the training in physiology cannot be over-estimated. Here in Edinburgh we are the fortunate possessors of a School of Physiology, built up by one of the greatest living authorities on that

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subject, Sir Edward Sharpey-Schafer, which is distinguished alike for the original work it produces and for the high standard of its teaching, as also for the fact that Sir Edward's pupils hold chairs of physiology in many Universities in this country and in the Western Hemisphere. Medicine owes much of its progress to the specialisation of physiology, pathology, and the other basal sciences. But medicine will never be a pure science; it is an art based upon sciences. There is, indeed, I venture to think, a progressive danger in the Schools, a direct consequence of the growth of knowledge, which threatens the training of the future practitioner, for it stands to reason that the scientific expert, the product of specialisation whose primary consideration is research, cannot be expected to realise to the full the relative application of the science of physiology to the demands of medical practice. The time has come, I believe, when the student's training in physiology should be supplemented by the addition of a course of applied physiology given by a practising physician.

The Clinical as contrasted with the Physiological Outlook.—The mental outlook must receive due consideration in the training of the future practitioner. What, indeed, is the purpose of education? Is it not to train the mind to store knowledge in a form in which it is most readily available for the purposes for which it is acquired and to develop the receptivity of the mind to this end, in addition to stimulating thought, creating a relish for knowledge, and exercising the faculty of judgment?

Now while the mental outlook of the physician is necessarily quite different to that of the physiologist, there is a progressive tendency to assume that the student should acquire his experience of medicine as a graft, so to speak, upon a mental framework of physiological knowledge. This is, in my opinion, a fundamental misconception which calls for correction.

The physician's aim is the recognition and treatment of disease; he must be first and foremost an observer. When the student commences the study of medicine he must cultivate an entirely different attitude of mind to that to which he has been accustomed by his previous physiological training; he must concentrate upon observation and study the natural history of disease; he must build up in his mind a mental framework of personal observations and experiences to which his thought and reading are complementary and to which

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he attaches his physiological and pathological knowledge in due proportion. While the student must familiarise himself with the methods of precision and learn to appreciate their significance, his teachers must see to it that he does not over-evaluate scientific procedures which are but means to an end; the student would do well to remember that the artist who concentrates unduly upon detail and technique may thereby spoil the picture as a whole. Early in his career he must learn that the practising physician is called upon to deal with disease as it affects the individual human being and that a true diagnosis does not consist in naming the disease from which the patient suffers but in eliciting *all* the facts (history, symptoms, and signs) the case presents, in utilising the relative scientific procedures which may further his conclusions, in placing the data, both physical and mental, in their correct perspective, and in attempting to advance a reasoned explanation which will account for them. This is what we mean by medicine.

I repeat that the mental outlook of the practitioner must be essentially clinical and that the cultivation of an attitude of mind which under-estimates clinical observation, and attaches undue importance to the results of the laboratory and to methods of precision, constitutes a grave menace to the undergraduate training at the present time.

The Creation of the Clinical Attitude of Mind.—How then are these dangers to be met? There is, in my opinion, only one way, and that is by concentration upon, and in direct relation to, the training in the Hospital. Were you to ask me to what I attribute the reputation of our School for its undergraduate training in medicine, I would have no hesitation in saying that it is the thoroughness and method of our clinical teaching and particularly our system of case-recording. I am personally convinced that it is by laying still further emphasis on this side of our teaching that we can counteract the dangers to which I have referred. Much more importance should be attached to the student's work in Hospital, and he should receive much more encouragement than he does at present to think and read in direct relation to his clinical work, for this is the only way to acquire a real knowledge of medicine.

Most of you will, I am sure, agree with me when I say that an evil, unfortunately a necessary evil, of a University education is the examination. As the years pass by the

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curriculum becomes increasingly overcrowded. The lot of the student of to-day, especially the man with a poor memory, is indeed far from a happy one, for the examination bogie is constantly before him. The student is too often haunted by the thought that he would be better employed, from the examination point of view, sitting at home reading his notes than working in the Hospital and reading in connection with his Hospital work. There can be no question that if the student knew that his Hospital work and case records were to be largely taken into account in judging of his fitness to graduate he would be encouraged and indeed compelled to spend more time working in the Hospital and in thinking and reading in direct relation thereto. Again, if the student, when he appeared for his final examination, were required to produce adjudicated case records dealing with different types of disease, in the compilation of which he had employed and discussed the methods of precision called for in each instance, he would thereby learn to estimate and appreciate the relative value and significance of the latter. This would, in my opinion, provide the best corrective in educating the student's sense of proportion and in dealing with one of the chief dangers which besets the training of the future practitioner.

The Place of Systematic Teaching.—I would refer to the place of systematic teaching in the training of the practitioner. The course of a hundred systematic lectures has long been a feature of our teaching, and in Edinburgh we have had many great didactic teachers. Introduced at a time when text-books were practically non-existent, such a course serves a useful purpose since it enables the lecturer to cover the subject and at the same time gives the student a sense of perspective. I am expressing my personal opinion, however, when I say that it is possible to over-estimate the relative importance of a course of the kind and that such systematic teaching has certain undoubted disadvantages. Systematic teaching forms a necessary part of the training in medicine, but its true place is complementary to the student's work at the bedside, and the separation of systematic from clinical teaching is, in my opinion, an anachronism.

Another disadvantage of the independent systematic course of lectures is that it encourages the type of man with the good verbal memory who works with the idea of obtaining honours as his chief aim and who is sometimes apt to think—a mis-

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apprehension which even time may fail to eradicate—that a knowledge of his notes is the equivalent of a knowledge of medicine. Many of us can probably recall men of this type who after distinguished undergraduate careers have, so to speak, lived their lives within their notes.

Then there is, I think, a further disadvantage of a complete systematic course. The didactic lecturing in medicine was of a very high order in my student days, a feature which my old friend and teacher, Professor Lovell Gulland, has so admirably maintained, but it has struck me since that these courses were sometimes too perfect and too complete, leaving little to the imagination.

But the greatest objection I have to the complete course of systematic lectures is that it tends to discourage the habit of independent reading, the student believing that a knowledge of his notes is all that is necessary for examination purposes.

The Replacement of the Systematic Lectures by Lecture-Demonstrations.—The complete course of a hundred systematic lectures should, in my opinion, be dispensed with, for I believe that the hours so occupied at present, *when the Professor has the opportunity of teaching all the students of the year*, might be utilised to much greater advantage in the student's training. I repeat that the student should receive his systematic instruction from the first in direct relation to his clinical work. My own view is, that the course of fifty systematic lectures given to the junior students who are commencing the study of medicine should be replaced by an introductory course of lecture-demonstrations given by the Professor of Medicine, in one of the Clinical Theatres in the Hospital, with patients as texts. The purpose of such a course which is not intended to develop the powers of observation, a faculty which can only be acquired at the bedside, would be to give the student living pictures of actual cases illustrating the commoner disorders met with in Hospital practice instead of verbal descriptions, to indicate to him how the physician observes and thinks, to teach him how to apply his physiological and pathological knowledge to cases of disease, to initiate him into general principles and the true way to acquire knowledge and, last but not least, to create in him a spirit of enthusiasm for the study of medicine. Further, these demonstrations should be supplemented by brief vivid systematic descriptions of the disorders exhibited, and by associated demonstrations in

Professor Edwin Bramwell

morbid anatomy. This is a method of teaching which can be made most attractive and which, in my opinion, would serve as an infinitely more useful introduction and groundwork to the student about to commence the study of medicine than a course of fifty systematic lectures.

Further, I would replace the course of fifty systematic lectures to the senior students by a course of lecture-demonstrations given in the Hospital. These lecture-demonstrations would be undertaken by individual members of the teaching staff. Professors and Senior Lecturers would be invited by the University to lecture upon various departments of medicine to which they had devoted special study and in which they were recognised authorities. To each lecturer a definite number of hours would be allotted and the lecturer would be asked to keep in view the requirements of the practitioner. While no attempt would be made to cover the whole subject, the student would receive a series of printed slips which would serve to systematise his reading. Although a good lecturer may be able to give an attractive course covering the whole field of medicine, it is generally recognised that no one man can nowadays pose as an authority in all departments, and the growing tendency of the Schools is to depute individual lecturers to teach upon special subjects which they have made their own. At the same time a short systematic course of lectures just before graduation would prove of value in co-ordinating the student's knowledge and experience.

The Undergraduate and Research.—But what of research? I hope that I shall not be misunderstood by the man in the street when I say that there is a great deal of nonsense talked about the doctor and research. The idea that any medical man may at will become a fruitful research worker, if so inclined, is a popular misconception. A small number of you will become research workers and there is no higher ambition that a man can have. But only a small proportion of individuals have, or will ever acquire, the research type of mind, and the research worker must develop himself by assiduous study after graduation. Highly as we value research, we must not allow the idea of research, in the generally accepted meaning of the word, to interfere with the direction of the undergraduate's training.

A Final Word.—There are great possibilities of forwarding medicine in the field of general practice; indeed we owe some of our greatest advances to men in general practice. The

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teacher of medicine must constantly keep these possibilities before him. He must not adopt the attitude of the dogmatic dominie who sets out with the sole purpose of filling the minds of his pupils with knowledge and fails to stimulate their powers of thought and imagination. He must try to be suggestive and inspiring in his teaching; he must remember that the majority of the men with whom he comes in contact intend to practise and that they will have opportunities of adding to the sum of knowledge in the field of general practice; he must indicate and illustrate the possibilities of advancing medicine by clinical observation; he must attempt to arouse the student's spirit of inquiry, stimulate his imagination, teach him to balance facts and recognise fallacies—educate him, in short, so that he leaves the University with a recognition of his potential powers and with the desire and ambition to further, if he can, the progress of medicine.

PERISCOPE

UNUSUAL CERVICAL TUMOUR.

Cavernous cervical lymphangiomata are well known as congenital tumours, but as tumours developing late in life and especially as bilateral and symmetrical swellings are of extreme rarity. Herepey-Csábányi records the occurrence in a woman, 58 years of age, in whom the swellings had been observed during ten years. The appearance of the right had preceded the appearance of the left tumour by a few months. The increase in size, which latterly had been much more rapid, was unaccompanied by pain. Each tumour extended from the sternal attachment of the sternomastoid muscle to mid-clavicle and upwards along the posterior border of the muscle. The tumours did not communicate and the vagueness of the fluctuation led to the diagnosis of lipoma. Operation disclosed deep to the sternomastoid a transparent, nodular, apple-sized growth like a bunch of grapes and histologically showed the typical characters of a cavernous lymphangioma.

Though occurring in old age the tumours had doubtless a congenital origin. The only effective treatment of these tumours is complete removal, a difficult undertaking sometimes on account of their ramifications and the thinness of the cyst walls.

G. V. HEREPEY-CSÁBÁNYI, "Doppelseitiges Lymphangioma cavernosum am Halse" (*Zentralbl. f. Chirurg.*, Leipzig, 1927, liv., 1672).

TENDON-SHEATH TUMOURS.

In an interesting paper on tumours of tendon sheaths Janik contributes five new cases.

1. Female, aged 24 years. The tumour projected superficially from the tendon of the right flexor pollicis longus. It was of one year's duration. A portion of the tendon sheath had to be excised with the tumour. Examination showed it to be a chondroma with irregular calcification towards its periphery.
2. Male, aged 25 years, whose tumour of the plantar aspect of the proximal phalanx of the right index toe was of three years' duration. It was attached to the sheath deep to the tendon. The toe was disarticulated at the metatarso-phalangeal joint. The tumour was a chondroma with some calcification.

Periscope

3. Male, aged 43 years, whose tumour on the volar aspect of the distal portion of the right forearm was of three months' duration. The tumour was attached to the sheath of the flexor carpi radialis and involved the tendon, part of which had to be sacrificed in excision of the tumour which proved to be a fibrochondrosarcoma, in places myxomatous and in places osteoid.
4. Male, aged 40 years, had during five years an enlarging tumour anterior to the right wrist. It was excised with part of the sheath of the flexor digitorum sublimis, and examination showed it to be a hæmangioma.
5. Female, aged 32 years, whose tumour of eight years' duration had veered from the palmar to the radial side of the left index finger near "the interphalangeal joint." It was attached by a long pedicle to the flexor sheath and was histologically a fibroma sarcomatodes.

Rare as are tumours of the tendon sheaths, tumours of the tendons are rarer still. Some writers indeed deny their existence, but when desmoid tumours of the fibrous intersections of the rectus abdominis muscle are remembered it would be illogical to expect immunity for tendons. The writer states that fibroma, osteoma, and sarcoma are the only tendon tumours which have been reported. But chondroma cannot be excluded, and both it and fibroma are liable to myxomatous degeneration.

Of the tendon sheaths, the tumours affecting them are: 1. Fibroma (13 cases published). 2. Lipoma, (a) simplex; (b) arborescens. 3. Chondroma (often mixed with fibrous strands and frequently calcified in parts or more rarely ossified). 4. Angeioma. 5. Myeloma (70 cases published). 6. Xanthoma (in hypercholesterinæmia). 7. Sarcoma (93 cases published).

The diagnosis of these tumours is by no means easy, tumours of the adjacent parts being confusing and tuberculous tendovaginitis difficult to exclude.

A. JANIK, "Tumours of Tendon Sheaths" (*Ann. Surg.*, Philadelphia, 1927, lxxxv., 897).

INTESTINAL FIBROMATA.

Clifton and Landry in a valuable paper on fibromata of the intestines properly include with the pure fibroma, myxoma and the varying combinations reported as fibromyxoma and myxofibroma. Fibroma of the mesentery is not included, and all fibrous modifications of adenomata and myomata are eliminated and neurofibromatosis ineligible. They present in tabular form the principal details of

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45 published cases. The case the authors add is that of a male Swede, aged 48 years, whose recurrent epigastric colic, nausea, distension with gaseous eructations and occasional vomiting had lasted only about six weeks. Radiography suggested mechanical obstruction of the small intestine towards its caecal termination. Two months later, previous to operation, a definite mass which was hard, movable, and tender in the left lower abdomen led to a diagnosis of carcinoma of the sigmoid. On coeliotomy a reducible chronic intussusception of the ileum was dealt with by resection of some 250 mm. of the small intestine as it contained the tumour—a fibroma.

Though fibroma of the stomach is not included in this paper, analogy would lead to the expectation of fibromata of the intestine. The location of the intestinal tumour is given by the authors thus:—

| | | | |
|---------------------------------|----|----------------------------|---|
| Duodenum | 1 | Ascending colon | 1 |
| Jejunum | 3 | Transverse colon | 2 |
| Ileum | 18 | Descending colon | 2 |
| Enteric (unspecified) | 7 | Sigmoid colon | 1 |
| Ileocaecal | 3 | Rectum | 4 |
| Caecum | 3 | | |

Intestinal fibromata may make themselves manifest at any age, and appear to be rather more common in females than in males. Statements as to dimensions of the tumour are regrettably rare, vague similarities being substituted, *e.g.* the size of a child's head, fist-size, size of a hen's egg and so on. Naturally opinions vary as to the site of origin, doubtless it is variable as fibromata may arise wherever there is connective tissue. Radiography does not differentiate the variety of obstruction. Intussusception is a common sequence and apparently almost always initiates and controls the symptoms. The treatment of choice is resection of the part of bowel supporting the tumour with or without previous reduction of the intussusception.

H. C. CLIFTON and B. B. LANDRY, "Fibromata of the Intestines"
(*Boston Med. and Surg. Journ.*, 1927, cxcvii., 8).

Note.—To their list of 45 cases might be added four others which the authors have overlooked. Thus a solid fibroma of the appendix is reported by Aman-Jean and Busser (*Ann. d'anat. pathol. et d'anat. normale médico-chirurg.*, Paris, 1927, iv., 428) in a female aged 64 years. Delagenière showed at a meeting of the anatomical society of Paris (15th April 1926) a pure fibroma whose maximum circumference was 310 mm., which had been removed with part of the small intestine from a ii-para, aged 21. Though this fibroma appeared to be in the mesentery, subsequent examination showed it had originated subperitoneally from the small intestine. Delagenière referred to a subperitoneal fibroma of the ileum reported by Labey and Baranger and to an enteric fibroma reported by Leroy.

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DELAYED ULNAR TRAUMATIC PARALYSIS.

Desgouttes and Denis report a typical case of this condition which occurred in a healthy female aged 18 years. On injuring her elbow at 3½ years of age medical advice had not been sought, but the child simply used the elbow as much as possible as soon as she was able. After some temporary stiffness the full movement was regained but the limb remained in pronounced cubitus valgus. Fourteen years after the accident she noticed that the hand was thinner and was becoming weak and less useful, and she had formication in the little finger. These symptoms increased until her admission to hospital. The muscular atrophy affected specially the hypothenar and interosseous muscles. There was neither objective sensory nor vasomotor disturbance. Radiography showed an old fracture of the lateral humeral condyle with consequent obliquity of the articulation. On operation the ulnar nerve was found in its sulcus behind the mesial epicondyle, its vascularity was increased, it was thick, and where compressed was flattened. The nerve was set free and passed to the anterior aspect of the mesial epicondyle, where it was fixed by a small slip of aponeurosis from the neighbouring muscles. The limb was put up in semiflexion. Though formication in the little finger continued during forty-eight hours, within a fortnight the limb had returned to normal and the muscles of the hand had regained their bulk and power.

Delayed paralysis of the ulnar nerve after an injury is not a common occurrence, and its mechanism is somewhat obscure. After fracture of the lateral condyle the gradual displacement of the ulna while the articular surface readjusts itself as growth proceeds may be of causal importance but cubitus valgus is not present in every case. The treatment indicated is (1) enlargement of the sulcus, (2) supracondylar cuneiform osteotomy, and easiest and most reliable (3) displacement of the ulnar nerve to the front of the epicondyle. The authors advise that the doctor who treats a fracture at the elbow in a child should warn the parents of the possibility of late complications.

L. DESGOUTTES et R. DENIS, "Les paralysies tardives du cubital à la suite des fractures du condyle externe de l'humérus" (*La Presse Médicale*, Paris, 1927, xxxv., 868).

MULTIPLE FIBROMATA OF THE TUNICA VAGINALIS.

A man applied for advice because he discovered four or five nodules within the scrotum. Examination showed many small nodules suggestive of sclerosed obliterated veins. They were discrete, not adherent to the skin, and appeared like excrescences on the anterior surface of the right testis. The epididymis, the testis itself and the

Periscope

ductus deferens appeared normal. There was no hydrocele, no glandular enlargement, and rectal examination was negative.

He had noticed at the age of 33 years a small swelling about the size of a cherry stone. It could be moved about within the scrotum, and naturally occupied the most dependent part until some three months ago when it became fixed at the superior part of the testis. The other nodules had appeared during the past six months and also seem to have been originally free and mobile:

On operation five very hard rounded tumours were found adherent to the parietal and visceral hydrocele surface. One was so adherent that removal necessitated excision of the subjacent part of the tunica albuginea. Almost the entire tunica vaginalis was removed with the little tumours. Three pin-head-sized nodules on the visceral layer of the tunica vaginalis were destroyed by the thermo cautery.

P. STRICKER et A. FRANCK, "Fibromes multiples de la tunique vaginale" (*Journ. d'urol.*, Paris, 1927, xxiv., 53).

A NEW TREATMENT FOR GYNÆCOLOGICAL AND OTHER HÆMORRHAGES.

A novel treatment for hæmorrhage from the female generative organs which appears to be as effective as it is simple is advocated by Tzovaru and Mavrodin. The addition of anything under 10 per cent. of citrate of soda to blood in order to prevent or hinder coagulation is well known and in common use in transfusion. Hedon in 1917-18 pointed out that the effect of citrate of soda on blood depended on the strength of the solution used, and that a solution of 30 per cent. instead of being anticoagulant when introduced into the circulation in rabbits was invariably hæmostatic, diminishing the viscosity of the blood, making the blood more fluid, and by increasing its coagulability rendered it antihæmorrhagic. In 1922, Neuhof and Hirschfeld verified their experiments on dogs and then tried it clinically with most satisfactory results on 500 cases of hæmorrhage, including various internal hæmorrhages, external hæmorrhages, secondary or post-operative hæmorrhages in abdominal and cranial operations, and as a prophylactic before operations on the liver.

Renaud and Juge (1924) tried it in hæmorrhages from cancer of the uterus and found it extremely satisfactory. It did not, of course, alter the course of the disease, but the cessation of the bleeding gave material and great mental comfort to the sufferers. "The action of citrate of soda," they write, "on cancerous hæmorrhages is so apparent and so reliable that since employing it we have not had, in an extensive clinical experience, a single patient who bleeds." This is strong testimony.

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Schwartz in the same year employed it with complete success in a girl aged 13 $\frac{6}{12}$. Nastasi of Rome also found the treatment reliable though his experience was not gynaecological. One recalls the frequent uselessness of curetting, the uselessness of medicinal treatment, and the secondary results of radium treatment so simple and effective as the intravenous administration of a 30 per cent. solution of citrate of soda calls for consideration from every gynaecologist.

The cases reported by Tzovaru and Mavrodin are as follows:—

1. A ii-para, aged 30 years, who had had two miscarriages was reduced to a very anæmic condition by abundant metrorrhagia of a week's duration. The uterus was tender, fixed and slightly increased in size, the right appendages boggy and the left cystic. Intravenously 15 cmc. of a 30 per cent. solution of sodium citrate was injected and within two hours the metrorrhagia ceased.
2. A nullipara, aged 32 years, had metrorrhagia of three weeks' duration. Ergotin, hydrastis and other drugs had been ineffective. Examination discovered a cervical polypus. Four hours after the injection of 10 cmc. of a 30 per cent. solution the hæmorrhage had ceased. At the next menstrual period loss of blood produced some anxiety, and two injections of 10 cmc. of the same solution were administered at three hours' interval and the discharge definitely ceased on the same day. Operation was arranged for at leisure.
3. A iii-para, aged 48 years, suffered during four months from metrorrhagia, after a menopause at 42 years of age. An inoperable carcinoma of the cervix was found. On three occasions within twenty-four hours 10 cmc. of a 30 per cent. solution were administered, and four hours later bleeding had ceased and did not recur during the two months she remained under observation.
4. A iii-para, aged 43 years, had during two weeks menopausal metrorrhagia. Examination negative. At a six-hours' interval two 10 cmc. injections of a 30 per cent. solution were administered and all red discharge had ceased by the following morning.
5. A nullipara, aged 28 years, with a definitely positive Bordet-Wassermann blood reaction had developed metrorrhagia a month previously. She had three 10 cmc. injections of 30 per cent. solution at two hours' intervals, and on the third day all discharge had disappeared. The syphilis was then treated.

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6. A i-para, aged 25 years, with a fibromatous uterus had metrorrhagia and menorrhagia during three months. At the onset of menstruation she had 15 cmc. of a 30 per cent. solution injected intravenously. There was no further loss of blood.

Such cases require no comment but the treatment obviously calls for trial.

- S. TZOVARU et D. MAVRODIN, "Arrêt rapide des hémorrhagies génitales de la femme par des injections de solution concentrée de citrate de soude" (*La Presse Méd.*, Paris, 1927, xxxv., 986).

OSTEOPSATHYROSIS.

A year ago J. Dereux gave a full and very interesting report of the case of a girl, aged 17, the subject of deformities due to osteopsathyrosis. *L'osteomalacie infantile*, the term he uses, is perhaps less appropriate than one which merely records the loss of rigidity. She was the elder of two, and the parents were well and healthy. The mother had had a miscarriage three months before the pregnancy which terminated in the birth of the patient. Parturition was at term and the labour was normal. The child appeared to be healthy, she was bottle-fed and walked at eight months. When a year old she fell from a chair and fractured her right femur. A month later while moving in bed she fractured her right humerus. Since then she had innumerable spontaneous fractures, one occurring about every month until she was admitted to hospital at the age of 3 years, where she remained until she was transferred to the Salpêtrière. Unable to walk, greatly deformed, though free from pain, she remained very helpless. The thorax was deformed, the sternum angled forward and there was an exaggerated kyphoscoliosis. The hands were long and thin, the clavicles, ribs and all the long bones were deformed, but the skull was unaffected. The muscular reflexes were normal. The operation of appendicectomy had been performed but no details of this are given. There was no Bence-Jones reaction and the Wassermann reaction was definitely negative. Though 17 years of age she had not yet menstruated, but there were commencing signs of puberty.

In a communication made to the same journal ten months later Dereux records the extraordinary improvement in general health and in the condition of the bones which had followed the establishment of menstruation. The deformities, as in all such cases, of course remain, but the body is plump, the flesh is firm, and the fullness of the breasts lessens the protuberance of the abdomen. The bones have become

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solid and resistant. Vesical and bilateral renal calculi which radiography had showed to be present at the time of the former report still cast shadows, interesting proof of one means of elimination of the calcium with which the system is supersaturated during active osteopsathyrosis.

J. DEREUX, "L'ostéomalacie infantile" (*La Presse Méd.*, Paris, 1926, xxxiv., 834, and 1927, xxxv., 573).

FUNCTIONAL RECOVERY AFTER PROLONGED DRAINAGE IN MEGACOLON.

A male child, the subject of megacolon, was operated on at the age of 6 years, a cæcostomy only being performed as adhesions prevented a sufficiently extensive colectomy. During the subsequent four years the artificial anus progressively diminished until merely a small intestinal fistula, which only permitted the escape of a little flatus, remained. Six years after the cæcostomy a cœliotomy was done for inspection of the parts and with a view to closing the small fistula. The great intestine was found to have regained almost its healthy condition in place of the quondam enormous fleshy bowel about 150 mm. in diameter, and the cæcum appeared quite normal. Radiographic observations had confirmed the progressive improvement. The boy's general condition is good and the bowels move daily. No relapse had accompanied the gradual closure of the artificial anus.

This operation is recommended in cases where megacæcum coexists with megacolon or occurs alone. It is the operation of choice in very young children or in those whose general health makes a serious operation inadvisable.

MAYET, "Mégacôlon congénital de l'enfant opéré par anus cæcal résultat après six années," Soc. de chirurgiens de Paris, 18 fév. 1927 (*La Presse Méd.*, Paris, 1927, xxxv., 263).

NEW BOOKS

LISTERIANA

THE Centenary year of the birth of Joseph Lister brought a considerable addition to the already voluminous literature on the life and work of the pioneer of Modern Surgery.

Joseph Baron Lister, edited for the Lister Centenary Committee of the British Medical Association by A. Logan Turner, M.D., LL.D. Edin. (Oliver & Boyd), is a handsome volume issued to members of the Association who attended the Edinburgh meeting this year. In addition to a Biographical Sketch of Lister by Sir George T. Beatson, an essay on Lister as physiologist by Sir Edward Sharpey-Schafer, we have a judicious selection of Lister's "Ipsissima Verba," "Obiter dicta," and Letters, and an interesting note on his fellow residents in the Royal Infirmary of Edinburgh in 1854, by the editor. A number of Lister's former House-Surgeons contribute "Reminiscences of the Chief." The state of surgery before Lister began his work is suggested in an article "Before the Dawn," by Mr Alexander Miles, and Professor John Fraser indicates "The Influence of Lister's Work on Surgery." In contents and format this volume forms a worthy tribute by the Edinburgh School to its greatest alumnus.

The tribute of the Glasgow School is paid in an elegant volume, *Lister and the Lister Ward* (Jackson, Wylie & Co., price 12s. 6d.). As the title indicates, a considerable portion of the text is devoted to a description of the historical ward which saw the inception of the antiseptic method of wound treatment, and to the controversy which arose when circumstances raised the question of its preservation as a Memorial to Lister. The illustrations of the ward and its furnishings add greatly to the historical value of this volume.

Sir Hector Cameron's *Reminiscences of Lister*, issued as one of the Glasgow University Publications (Jackson, Wylie & Co., price 1s.), has the personal touch and charm to which the distinguished author's other writings on his master have made us accustomed.

Lister as I Knew Him, by J. R. Leeson (Baillière, Tindall & Cox, price 8s. 6d.), is a light and readable sketch, but adds little to our knowledge of Lister.

Through the courtesy of the Conservator, Mr W. L. G. Malcolm, we have received *The Wellcome Historical Medical Museum Handbook* and *Lister Centenary Exhibition at the Wellcome Historical Medical*

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Museum Handbook. These handsome little volumes are fitting records, the former of an industry which has provided a unique collection of great value and interest to the Profession, the latter of an occasion for hero-worship in which The Wellcome Historical Medical Museum authorities played such a conspicuously successful part. At the present moment the little volume devoted to Lister and his work, though perhaps the more ephemeral, evokes the greater interest. The collection of relics herein catalogued is wonderful, the portraits and illustrations are good, and the references to Lister and to his work neat and adequate. The list of Lister's diplomas, certificates, etc., collected as they are in this book, admirably convey the world-wide acclamation of Lister and the acceptance of the surgical principles which he initiated. The Wellcome Historical Medical Museum is to be congratulated on so efficiently commemorating this great Centenary.

Malaria. By ROBERT KNOWLES and RONALD SENIOR-WHITE. Pp. vi + 208, with 119 illustrations. Calcutta: Thacker, Spink & Co. 1927. Price Rupees 7, Annas 8.

In July 1898 Sir Patrick Manson at the Annual Meeting of the British Medical Association in Edinburgh gave a full account of the great discovery by Ross of the mode of transmission of malaria by the mosquito; and the present work gives a clear, accurate and interesting account of the malarial problem of to-day. The labours of the two able authors have produced a work of high scientific and practical importance, which will be a credit to the Medical Research Department of India and the School of Tropical Medicine at Calcutta. The volume can be confidently recommended to all medical men in the Tropics and to others who have to deal with the great problem of malaria. It will be specially valuable to workers in India, but those in other tropical countries will also derive much benefit from a close study of it. The book is divided into six chapters dealing with the parasite, the diagnosis and treatment of malaria, mode of carrying out a malarial survey and anti-malarial measures.

The Conduct of Medical Practice. By the Editor of *The Lancet* and Expert Collaborators. Pp. xv + 332. London: published by *The Lancet*. Price 10s. 6d.

This book incorporates, in whole or in part, a series of articles which have appeared recently in *The Lancet* on "The Conduct of Medical Practice." It contains a vast amount of information with which it is essential that the doctor should be familiar, but of which he learns almost nothing in the course of his undergraduate career. It outlines the various careers open to the young graduate, and how best a man

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intending to become a family doctor may prepare for his work. The points to be considered in entering on an assistantship and in purchasing a practice are gone into, while the relation between doctor and patient, the questions of medical secrecy, and the details of running a practice, panel or otherwise, are elaborately described. The functions of that little understood body, the General Medical Council, are explained, and its relations to the public and to the doctor traced.

The various medico-legal situations that may arise in the course of everyday work are detailed, and the method of meeting them explained. Valuable hints are given as to bookkeeping and making up an income tax return, though the latter is a little too complicated to be intelligible to the man starting practice. The book as a whole is indispensable to the young doctor if he wishes to avoid some of the pitfalls into which his seniors have stumbled; he should like to point out that Edinburgh as well as Cambridge gives a diploma on Medical Radiology and Electricity.

Health Supervision and Medical Inspection of Schools. By THOMAS D. WOOD, A.M., M.D., and HUGH GRANT ROWELL, A.B., M.D., Columbia University. Pp. 637, illustrated. London and Philadelphia: W. B. Saunders Company, Ltd. Price, Cloth, 35s.

In their preface, the authors state that they have prepared this book "to meet the recognised need of a thoroughly practical, comprehensive program of health supervision in schools." We can congratulate the authors, for there are few subjects connected with School Hygiene in its broadest sense which have not been dealt with in a thorough manner in their book. Though the volume is written by Americans on the supervision and treatment of American children, School Medical Officers of all countries will find it full of valuable information gathered from many sources.

In the introductory chapter, there is an interesting chronological table of the history and development of Medical Inspection in Schools. The chapter on weighing and measuring contains very useful standard tables. In dealing with the control of communicable diseases, the authors give, as we would expect, a full account of the Schick and Dick tests, including literature for distribution to parents, results of immunisation, and a coloured plate of Schick reactions. The chapter on Special Classes gives a detailed account of the methods and standards in use for selecting pupils for these classes and the organisation and administration of the same. There are also interesting chapters on the treatment and care of malnourished pupils, children with orthopedic defects, health supervision of teachers, supervision and care of the pre-school child, and the health of the child in industry.

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Throughout the book there are given many copies of schedules and forms in use in different parts of America either for recording examinations and investigations or for conveying intimation to parents regarding defects found; these make interesting reading, some on account of their elaborate detail, others because of the language in which they are couched.

The book has a good index which occupies about 40 pages and gives a good idea of its encyclopædic nature.

Forensic Psychiatry. By W. NORMAN EAST. Pp. viii + 381.

London: J. & A. Churchill. 1927. Price 16s.

Forensic Psychiatry is a book which fills a gap in forensic literature. Of recent years much attention has been paid to the mental condition of persons accused of crimes, and whilst there is no scarcity of books dealing with psychiatry or mental diseases, these deal with the question from the medical rather than from the forensic aspect, a distinction which unfortunately mental experts sometimes fail to appreciate. Dr East, before his appointment as Medical Inspector of Prisons, was for many years senior medical officer of Brixton Prison, and as such had a very considerable experience in this branch of forensic work. The results of this practical experience are embodied in his book. Dr East has had experience not only of insane criminals but of many cases where the question of insanity has been raised but not admitted by the courts. This has afforded him much material, and the chapter on criminal responsibility, a subject bristling with difficulties, is written in an extremely clear and interesting manner. We do not know of any work which gives such an excellent summary of the question. The book is clearly written and well illustrated with cases, a point of great value in forensic work. It will make an appeal not only to mental experts but to all engaged in criminal cases.

A Text-Book of Medicine. By AMERICAN AUTHORS. Edited by Russell L. Cecil, A.B., M.D., and Foster Kennedy, M.D., F.R.S.E. Pp. 1500. London: W. B. Saunders Company. 1927. Price 40s.

One hundred and thirty contributors, each dealing with a subject in which he is specially interested, have collaborated in producing this text-book. In dealing with a work of this size and scope it is impossible to do more than endeavour to convey an impression gained by reference here and there to the accounts of disease and its treatment in the various sections of the book. It may be said that such reference gives almost uniformly the greatest satisfaction.

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The writing is as a rule clear in style and well-balanced in its matter. The discussion of treatment is in most cases well up to date without claiming too much for methods still upon trial. The book is well printed upon good paper and is attractive in its form. The editors are to be congratulated upon producing a work which should prove of interest and of value to every physician and senior student.

A Text-Book of Psychiatry. By D. K. HENDERSON and R. D. GILLESPIE. Pp. x + 520. London: Oxford Medical Publications. 1927. Price 18s.

Good text-books of psychiatry in English are comparatively rare, but the work of these two physicians will do much to remove this reproach. The work opens with an excellent chapter on the history of psychiatric practice from the earliest times, and this is followed by sections dealing with classification, ætiology, methods of examination, and symptomatology. These are all characterised by a breadth of view and a well-balanced judgment which set the whole subject in its proper perspective. The subsequent chapters dealing with the various reaction types constitute the main body of the work, and in these the reader will find a vivid description of the various forms which a psychosis may assume, and a clear conception of the mechanisms by which the illness is produced. The chapters on mental deficiency and the psycho-neuroses are equally successful. In dealing with the latter there is no slavish adherence to the Freudian view-point, but every means that has stood the test of practical experiment is incorporated, whatever its origin.

Great emphasis is laid, and rightly so, on the question of insanity as a social problem, and its connections with general medicine have been clearly established. The whole work rests upon the biological hypothesis which Adolf Meyer has done so much to establish. Looked at from this angle, insanity is the end result of the individual's morbid reactions to his environment, extending over the whole period of his existence. That being so, mental illness, although it has many social implications, is an intensely personal affair, and can only be understood after considering the whole history of the invalid, and the ingredients which go to make up that elusive thing we call personality. These views add greatly to the interest of the many clinical records quoted in the text.

As a text-book for the student, this volume is certain to take a leading place, but in addition, the practitioner who is on the outlook for an up-to-date review of the whole subject could not be directed to a more reliable source.

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A Handbook of Diseases of the Stomach. By STANLEY WYARD, M.D., M.R.C.P. Pp. 387 with 32 illustrations. London: Humphrey Milford. 1927. Price 16s.

The value of this book lies largely in the fact that it is an exposition of the writer's personal views, evidently founded upon observation of a large number of cases. He openly challenges the value of many commonly employed procedures and medicaments, and the result is a stimulating account of gastric disorders which will tend to increase the reader's interest in observing the results of his treatment of many common ailments. The chapters dealing with gastric ulcer and gastric carcinoma are well written and show a wide experience of these conditions. There is a useful section on dietetics, and there are many X-ray illustrations which are both well chosen and clearly reproduced. This is a book which should prove of great interest and of practical value.

Clinical Neurology. By HANS CURSCHMANN, a free translation with changes and additions by E. A. STRECKER, A.M., M.D., and M. K. MEYERS, B.S., LL.B., M.D. Pp. xii + 410. Philadelphia: P. Blakiston's Son & Co. 1927. Price \$3.50.

The translators state in their foreword that they have found it advisable, to meet the needs of the American student and practitioner, to disregard and modify the original in the translation. The greater number of these changes and additions are so interspersed with the original text that it is impossible for the reader to differentiate the views of Professor Curschmann from those of his two American translators.

Neurology is sometimes apt to be shouldered aside by the practical demands of internal medicine and the dramatic setting and lure of surgery, and thus the student of medicine may later on find himself hopelessly out of his element when faced with a neurological situation. At the same time there is no sharp demarcation between internal medicine and neurology, and most serious nervous diseases come first in their earlier stages before the general practitioner, the neurologist many times only witnessing the terminal phases, which are often hopeless as far as treatment is concerned.

This volume is an attempt to prepare a brief exposition of the ordinary nervous diseases which come within the daily scope of the general practitioner, in a form which would be helpful to him. Special attention is thus directed to those symptoms which assist early diagnosis and to treatment.

NOTES ON BOOKS

How to make the Periodic Health Examination, by Eugene Lyman Fisk, M.D., and J. Ramser Crawford, M.D. (The MacMillan Company, \$4.00), is written by the Medical Director and the Assistant Medical Director of the Life Extension Institute of New York, where there has been fully developed the practice of examining periodically persons apparently healthy, with a view to recognising the beginnings of any structural or functional abnormalities so that corrective measures may be applied at a stage at which they are most likely to prevent any serious impairment of health. A method of conducting a systematic examination is here fully laid down. This is so thorough and painstaking, and so wide in scope, that one cannot but admire the degree of education of the general public which leads them to submit periodically to it. Quite apart from its use in this special direction, the book furnishes a valuable scheme for the comprehensive examination of patients which should be useful in the training of students and house physicians.

In his *Introduction to Physiological Chemistry* (John Wiley & Sons, Inc.), Dr Bodansky has supplied what was needed. He handles his subject-matter in an attractive fashion and gives in small compass an up-to-date account of the essential facts of biochemistry.

Transactions of the American Gynecological Society, Vol. li., edited by Arthur H. Curtis, M.D. (Dornan), comprise twenty-one communications, nineteen of which were read at the Annual Meeting of 1926, and include two papers of special interest on "Endometriosis," one of them by Sampson. "The present Status of the Induction of Labour by Pituitary Extract" by Scott, "Function of the Ovary" by Frank, and "The Clinical Significance of X-ray Pelvimetry" by Thoms are other contributions of importance. The high standard of previous years is fully maintained.

Segregation and Autogamy in Bacteria, by F. H. Stewart, M.A., D.Sc., M.D. (Adlard, 7s. 6d.), records a biological study of bacterial variation with particular reference to the coli-typhoid group. As a result of an extensive series of observations the author suggests that variation among the organisms studied may be explained by postulating a bacterial life cycle in which, after vegetative growth has ceased, a certain number of individual organisms go through segregation and autogamic conjugation. He thus correlates bacterial variation with that

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occurring among higher forms. The experimental data recorded are of great interest in regard to the process of bacterial variation. As a contribution to the knowledge of our subject the work is of value apart from any debatable speculation regarding the nature of the underlying biological processes.

Practical Lectures, delivered under the auspices of the Medical Society of the County of Kings, Brooklyn, New York, second series (1924-1926). New York (Paul B. Haeker, Inc. \$7.00). These lectures, thirty-seven in number, delivered to practitioners, are like other post-graduate addresses, a rather mixed "bag." They cover a wide field and embrace subjects on which every practising doctor is anxious to acquire fresh knowledge.

Most of the ordinary diseases one meets with are described and the most approved line of treatment indicated. We would direct special attention to three lectures dealing with disorders of the thyroid gland which give one a very complete working knowledge of the common affections of this organ. There are important articles on "The Management of Occipito-posterior Cases" and "The Medical Problems of Pregnancy"; while of general interest are chapters on "The Functions of the Public Health Services," "The Doctor in Court and 'Gails.'" Taken all round it makes a very instructive and readable volume.

Lectures on Internal Medicine, by Professor Kneel Faber of Copenhagen (Paul B. Hoeber, 3 dollars), comprise four lectures given during a visit to America in 1926. The subjects of these admirable lectures are achylia gastrica, in which parenchymatous gastritis is maintained to be an essential factor; pernicious anæmia, whose probable intestinal origin is discussed in an ingenious argument; benign glycosuria, where methods of estimating the sugar threshold of the kidney are described, and the differentiation of true diabetes from the types of benign glycosuria is discussed; and finally, an interesting historical sketch of the progress of therapeutics and of the ideas governing advances in treatment during the past hundred years. In the first three lectures, there is that note of competence and authority which comes from important personal contributions to the subjects discussed: and throughout there is shown not only wide knowledge, but also a power of examining and describing unsettled problems in medicine in a clear and critical way.

Bacterial Vaccines, by Professor Leonard S. Dudgeon (Constable, 7s. 6d.), completes another number of the series of Modern Medical Monographs. It is a small book, and does not claim to be a complete account of the subject. But it can be recommended in that it gives the principles of vaccine treatment and is a practical guide to their

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use. It is written by a competent bacteriologist with a long practical experience of vaccines. It is also brief and clear, avoiding long drawn-out argumentation, and in expressing personal views, does so without too much dogmatism. The greater part is occupied with the use of vaccines in the important bacterial infections—the dosage and technique of administration, and an indication of the results that may be expected. The author believes in the value of vaccines, and definitely indicates those types of cases where success may be expected; but he is sceptical, even courageously so, in many cases when enthusiasts have claimed great success, notably in the acute general infections. In these critical passages, he supports his own views and experience by extracts from other authorities. Both as a brief survey of this branch of therapeutics, and as a reliable guide to the employment of vaccines, it can be warmly recommended.

Social Factors in Medical Progress, by Bernhard J. Stern, Ph.D. (Columbia University Press, 2.25 dollars), is a psychological study of medical progress, and is somewhat limited and superficial. It shows how great advances and discoveries in medicine have met with bitter resistance, and gives the explanation in psychological terms of this resistance. Another point made is that too much attention is given to the genius of the individual in medical discoveries, and too little to the existing conditions which made the work of the individual possible. On p. 84 and p. 94, "John Symes" should of course be James Syme.

Text-Book on Diseases of the Skin and Syphilis, by Albert Strickler, M.D. (F. A. Davis & Co., \$8.00), is designed by the author for the use of students and practitioners. The illustrations, which are almost without exception excellent, are the best part of the volume. An attempt has been made to deal with too many diseases. Every known skin affection is mentioned. The descriptions are in many cases inadequate and would convey very little except to the dermatologist. The author would have done better had he described the common diseases more fully and omitted the numerous scrappy references to very rare affections which neither a student or general practitioner is competent to recognise. On the whole the volume is disappointing.

Whole-Meal, with Practical Recipes (Heinemann, 1s. 6d.), by Mrs Hornibrook, embodies much useful information on whole-meal, its dietetic uses and preparation, with very practically valuable recipes for serving it in palatable forms for the table. It also deals faithfully with trade propaganda directed against criticism of white bread.

BOOKS RECEIVED

- BRADLEY, O. CHARNOCK. Topographical Anatomy of the Dog.
Second Edition. (*Oliver and Boyd, Edinburgh*) 24s. net.
- BURT, CYRIL, M.A., D.Sc. The Measurement of Mental Capacities.
(*Oliver and Boyd, Edinburgh*) 6d. net.
- COBB, IVO GEIKIE. The Glands of Destiny.
(*William Heinemann (Medical Books) Ltd.*) 7s. 6d. net.
- CROHN, B. B. Affections of the Stomach.
(*W. B. Saunders Co., London & Philadelphia*) 45s. net.
- CUMBERBATCH, ELKIN P. Diathermy, its Production and Uses in
Medicine and Surgery. Second Edition.
(*William Heinemann (Medical Books) Ltd.*) 21s. net.
- CUSHING, HARVEY. The Meningiomas.
(*Jackson, Wylie & Co., Glasgow*) 2s. 6d. net.
- ELDER, WILLIAM, M.D. Studies in Psychology. Memory, Emotion,
Consciousness, Sleep, Dreams, and Allied Mental Phenomena.
(*William Heinemann (Medical Books) Ltd.*) 8s. 6d. net.
- FELDMAN, W. M. The Principles of Ante-Natal and Post-Natal Child
Hygiene (*John Bale, Sons & Danielsson, Ltd.*) 25s. net.
- HARE, HOBART AMORY. A Text-Book of Practical Therapeutics.
Twentieth Edition (*Henry Kimpton, London*) 36s. net.
- HENRY, ARNOLD K. Exposures of Long Bones and Other Surgical
Methods (*John Wright & Sons, Ltd., Bristol*) 10s. 6d. net.
- HOWELL, WILLIAM H. A Text-Book of Physiology. Tenth Edition.
(*W. B. Saunders Co., London and Philadelphia*) 30s. net.
- JORDAN, H. E. A Text-Book of Histology.
(*D. Appleton & Co., London and New York*) 25s. net.
- LAMB, WILLIAM. Practical Guide to Diseases of the Throat, Nose, and
Ear. Revised by FREDERICK W. SYDENHAM. Fifth Edition.
(*Baillière, Tindall & Cox, London*) 12s. 6d. net.
- LEYS, DUNCAN. Chronic Pulmonary Catarrh.
(*H. K. Lewis & Co., Ltd., London*) 7s. 6d. net.
- LOW, R. CRANSTON. The Common Diseases of the Skin.
(*Oliver and Boyd, Edinburgh*) 14s. net.
- M'CAW, JOHN. Aids to the Diagnosis and Treatment of Diseases of
Children. Revised by FREDERICK M. B. ALLEN. Sixth Edition.
(*Baillière, Tindall & Cox, London*) 4s. 6d. net.
- MACGREGOR, M. E. Mosquito Surveys.
(*Baillière, Tindall & Cox, London*) 15s. net.
- M'KEE, GEORGE M. X-Rays and Radium in the Treatment of Diseases
of the Skin. Second Edition (*Henry Kimpton, London*) 45s. net.
- M'KENZIE, DAN. Diseases of the Throat, Nose and Ear. Second
Edition. (*William Heinemann (Medical Books) Ltd.*) 45s. net.
- MACLAREN, J. PATERSON. Medical Insurance Examination: Modern
Methods and Rating of Lives. (*Baillière, Tindall & Cox, London*) 16s. net.

Books Received

- MACLEAN, HUGH. Modern Methods in the Diagnosis and Treatment of Glycosuria and Diabetes . . . (Constable & Co., Ltd., London) 12s. net.
- MOON, R. O. Growth of Our Knowledge of Heart Disease. (Longmans, Green & Co., Ltd., London) 3s. 6d. net.
- MORSE, W. Applied Biochemistry. Second Edition. (W. B. Saunders Co., London and Philadelphia) 32s. 6d. net.
- Notes on Clinical Laboratory Methods. Standing Committee on Laboratory Methods, University of Glasgow. (John Smith & Son, Ltd., Glasgow) 2s. net.
- ORDE, R. H. P. The Voluntary Hospitals in Great Britain (excluding London). Eighth Annual Report for the Year 1926. 1s. net.
- ROSEWARNE, D. D. A Text-Book of Actinotherapy. (Henry Kimpton, London) 9s. net.
- ROYSTER, H. A. Appendicitis. (D. Appleton & Co., London and New York) 21s. net.
- SHENNAN, THEODORE. Post-Mortems and Morbid Anatomy. Second Edition (Faber & Gwyer, Ltd., London) 25s. net.
- SHORT, A. RENDLE, and C. I. HAM. A Synopsis of Physiology. (John Wright & Sons, Ltd., Bristol) 10s. 6d. net.
- STEVENS, A. A. A Text-Book of Therapeutics. Seventh Edition. (W. B. Saunders Co., London and Philadelphia) 30s. net.
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